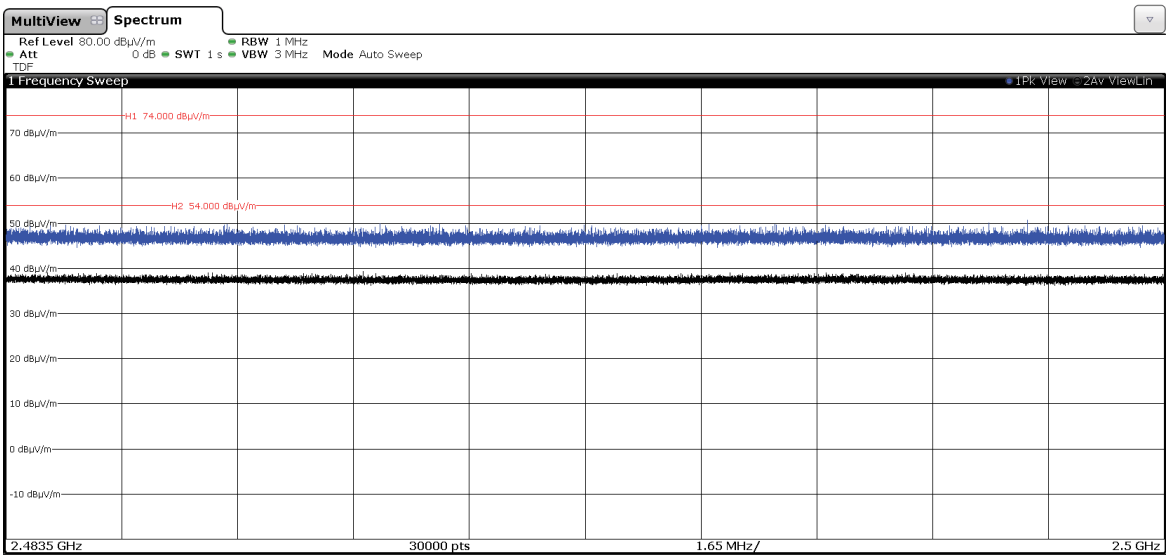
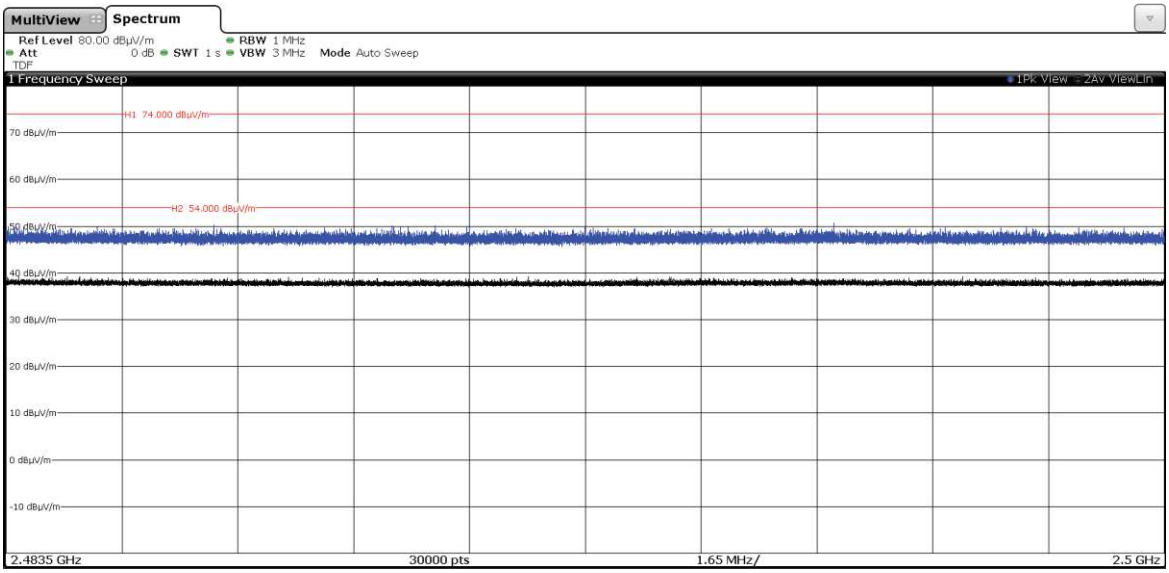
- **8DPSK**

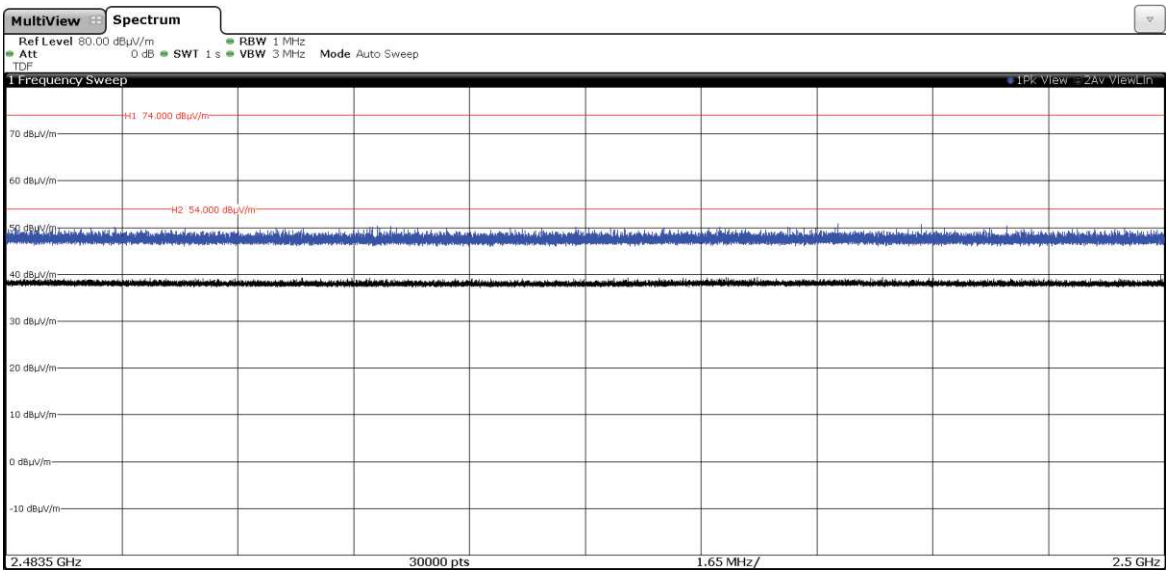

MultiView
Spectrum
Ref Level 80.00 dBµV/m
RBW 1 MHz
Att 0 dB
SWT 1 s
VBW 3 MHz
Mode Auto Sweep
TDF
1 Frequency Sweep
1Pk View
2Av ViewLin
H1 74.000 dBµV/m
H2 54.000 dBµV/m
70 dBµV/m
60 dBµV/m
50 dBµV/m
40 dBµV/m
30 dBµV/m
20 dBµV/m
10 dBµV/m
0 dBµV/m
-10 dBµV/m
2.4835 GHz
30000 pts
1.65 MHz/
2.5 GHz

- Middle Channel:

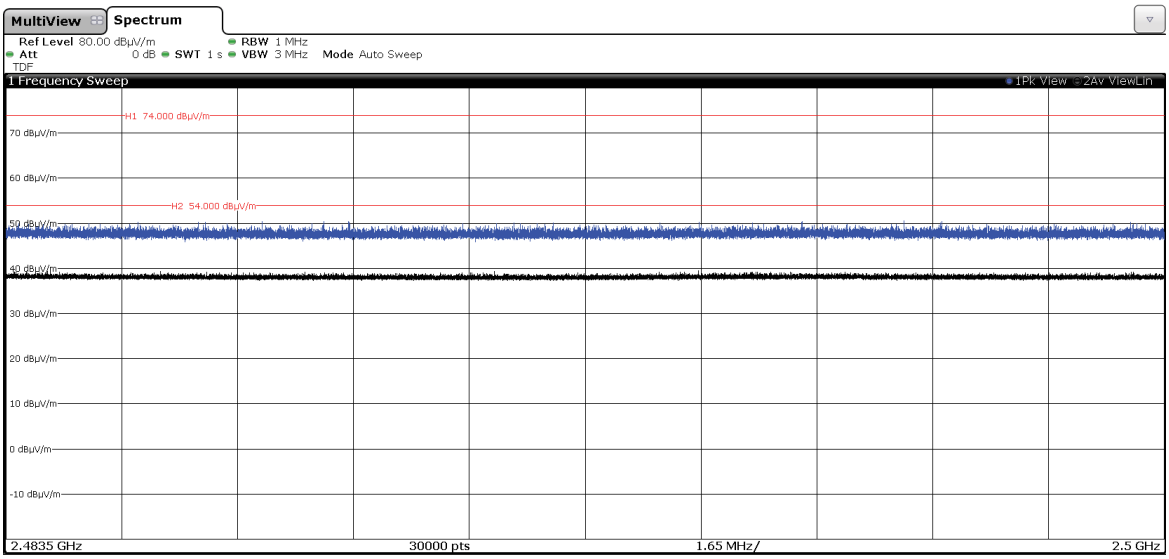
- **GFSK**



- **Pi/4 DQPSK**

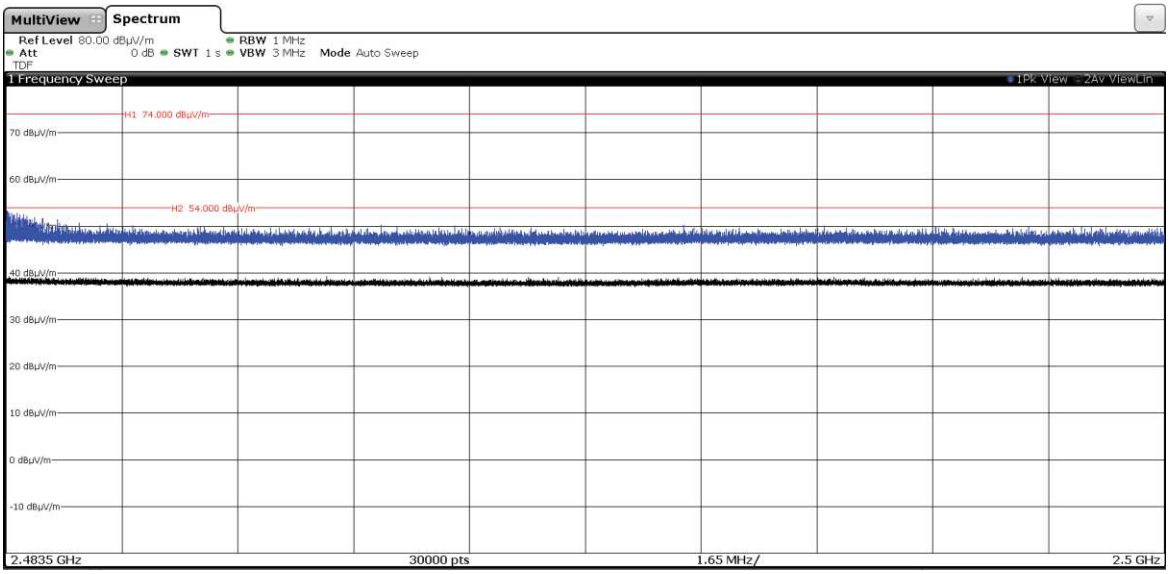


- **8DPSK**

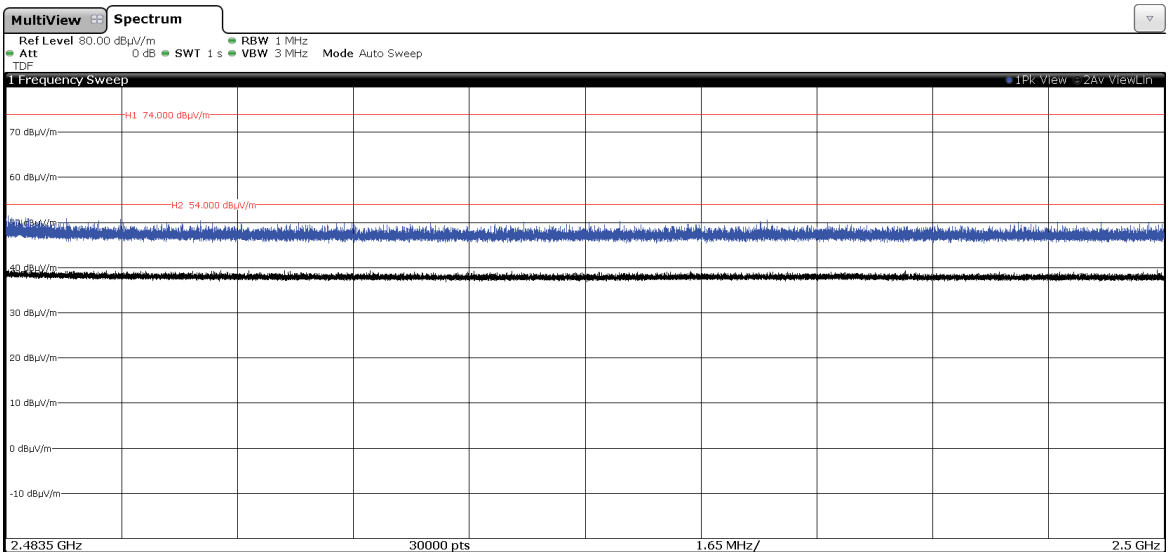

MultiView
Spectrum
Ref Level 80.00 dBµV/m
RBW 1 MHz
Att 0 dB
SWT 1 s
VBW 3 MHz
Mode Auto Sweep
TDF
1 Frequency Sweep
1Pk View
2Av ViewLin
H1 74.000 dBµV/m
H2 54.000 dBµV/m
70 dBµV/m
60 dBµV/m
50 dBµV/m
40 dBµV/m
30 dBµV/m
20 dBµV/m
10 dBµV/m
0 dBµV/m
-10 dBµV/m
2.4835 GHz
30000 pts
1.65 MHz/
2.5 GHz

- High Channel:

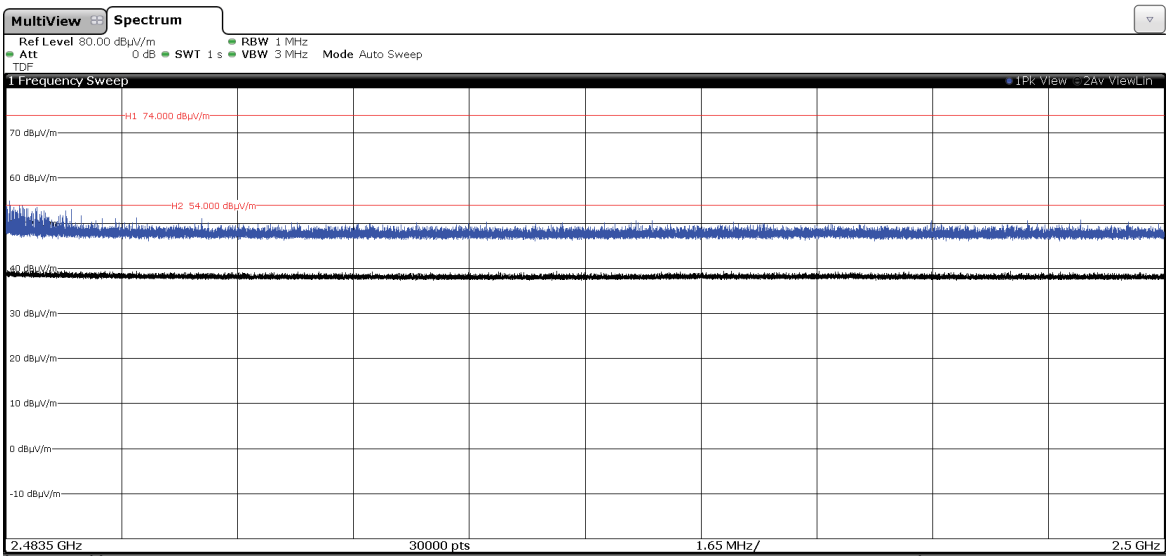
- **GFSK**



- **Pi/4 DQPSK**



- **8DPSK**


MultiView
Spectrum
Ref Level 80.00 dBµV/m
RBW 1 MHz
Att 0 dB
SWT 1 s
VBW 3 MHz
Mode Auto Sweep
TDF
1 Frequency Sweep
1Pk View
2Av ViewLin
H1 74.000 dBµV/m
H2 54.000 dBµV/m
70 dBµV/m
60 dBµV/m
40 dBµV/m
30 dBµV/m
20 dBµV/m
10 dBµV/m
0 dBµV/m
-10 dBµV/m
2.4835 GHz
30000 pts
1.65 MHz/
2.5 GHz

Appendix B: Test results. Bluetooth Low Energy.

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TEST CONDITIONS

POWER SUPPLY (V):

V nonimal:	3.8 Vdc
Type of Power Supply:	DC voltage from external power supply.
Type of Antenna:	Monopole with parasitic resonator.
Maximum Declared Antenna Gain:	-3 dBi

TEST FREQUENCIES:

Low Channel:	2402 MHz
Middle Channel:	2440 MHz
High Channel:	2480 MHz

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.

RADIATED MEASUREMENTS:

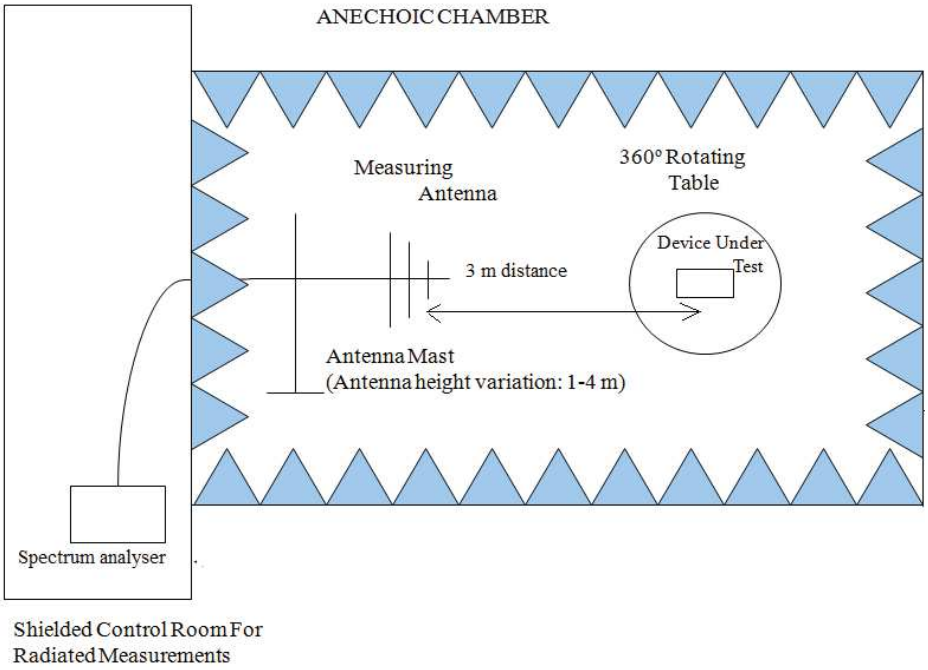
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

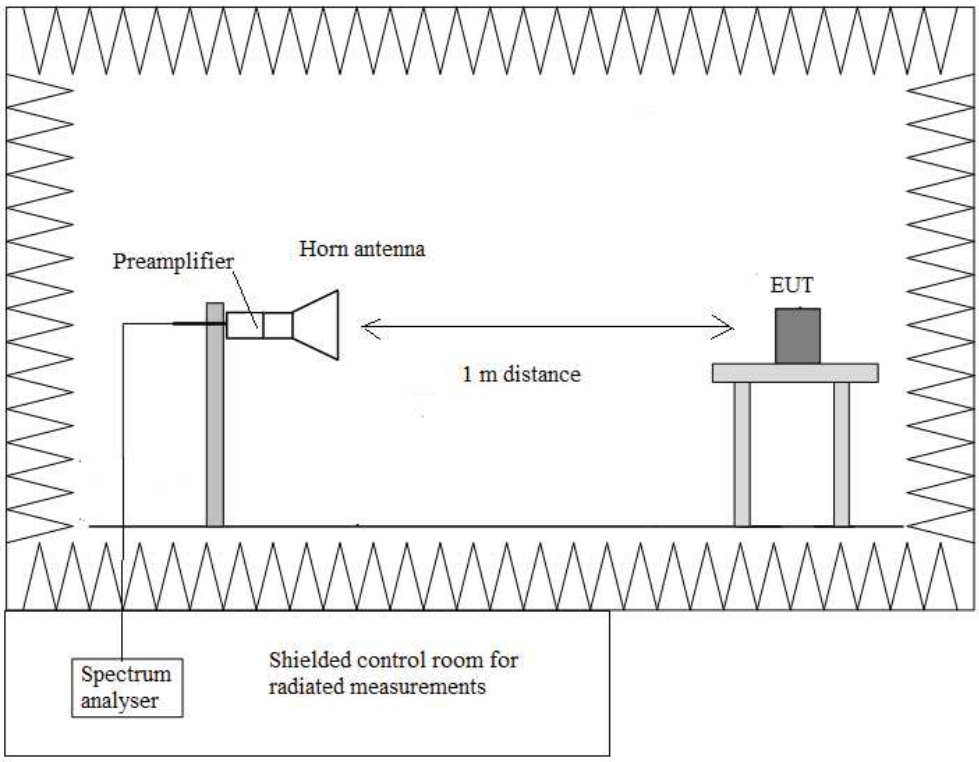
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup f > 1 GHz:

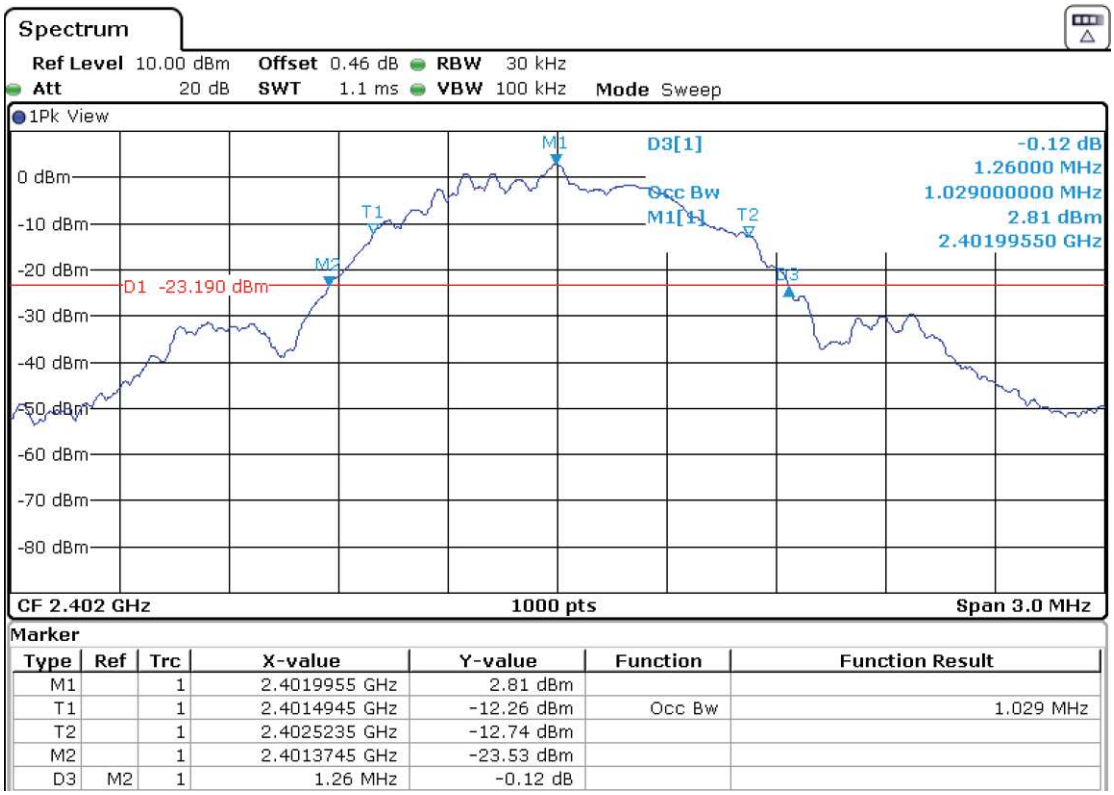


Occupied Bandwidth

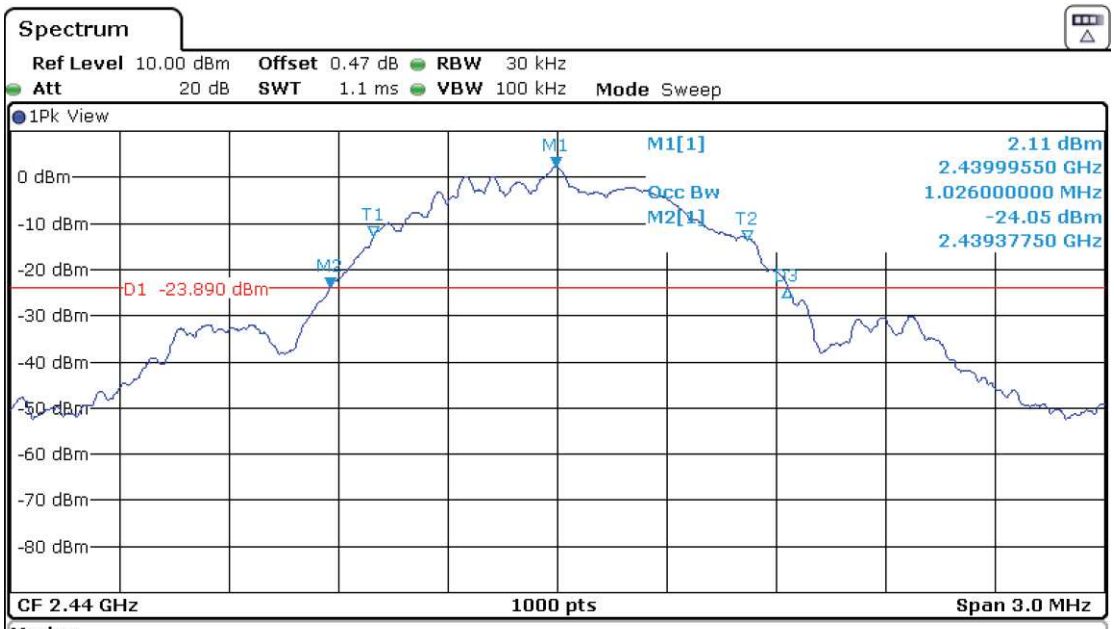
RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% Bandwidth (MHz)	1.029	1.026	1.026
-26 dBc bandwidth (MHz)	1.260	1.254	1.254
Measurement uncertainty (kHz)	<± 5.00		

- Low Channel:



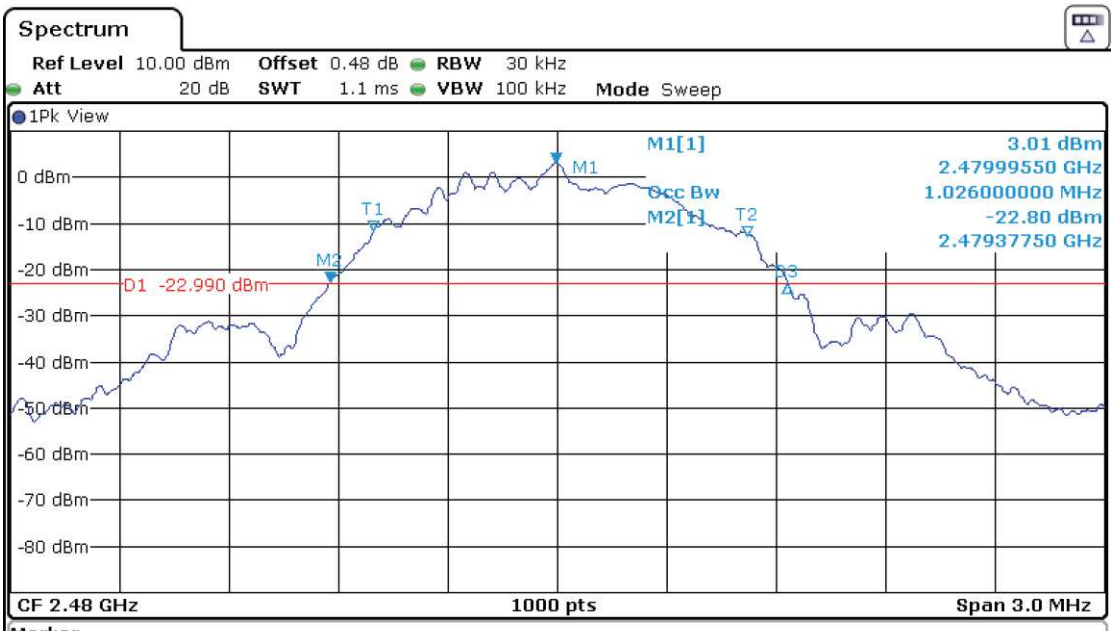
- Middle Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4399955 GHz	2.11 dBm		
T1		1	2.4394945 GHz	-12.84 dBm	Occ Bw	1.026 MHz
T2		1	2.4405205 GHz	-13.71 dBm		
M2		1	2.4393775 GHz	-24.05 dBm		
D3	M2	1	1.254 MHz	0.11 dB		

- High Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799955 GHz	3.01 dBm		
T1		1	2.4794945 GHz	-11.74 dBm	Occ Bw	1.026 MHz
T2		1	2.4805205 GHz	-12.74 dBm		
M2		1	2.4793775 GHz	-22.80 dBm		
D3	M2	1	1.254 MHz	-0.09 dB		

FCC Section 15.247 Subclause (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth.

SPECIFICATION:

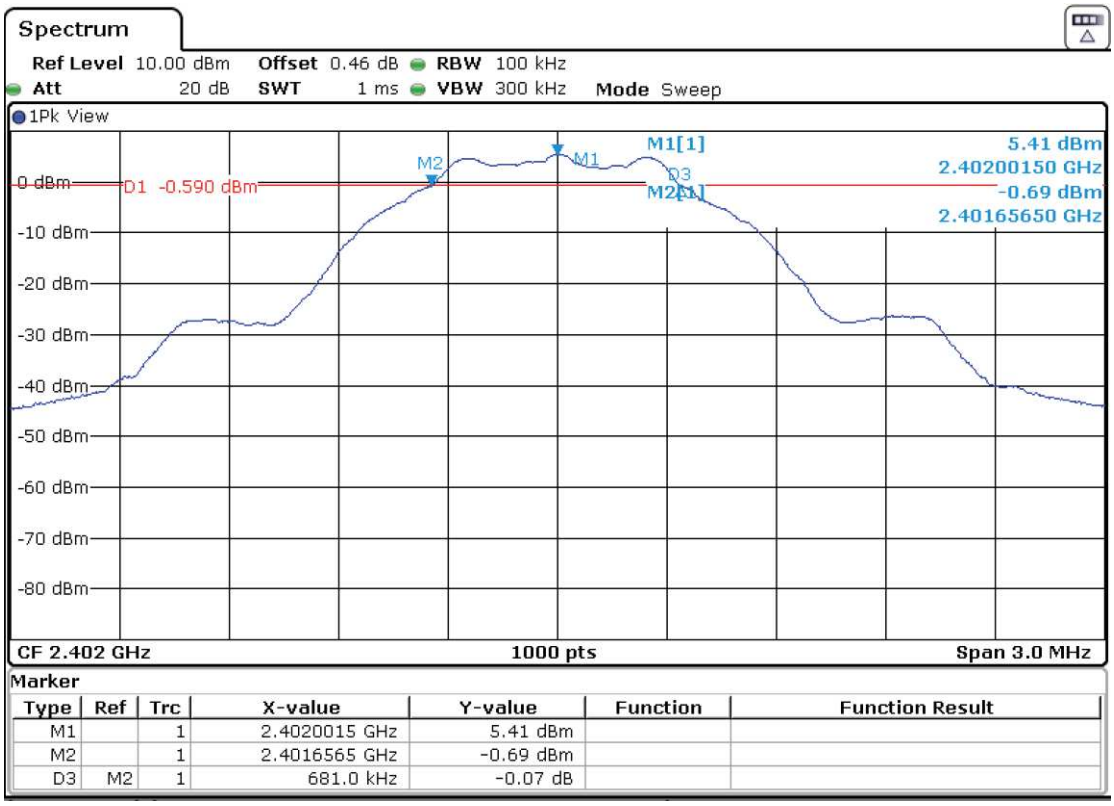
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

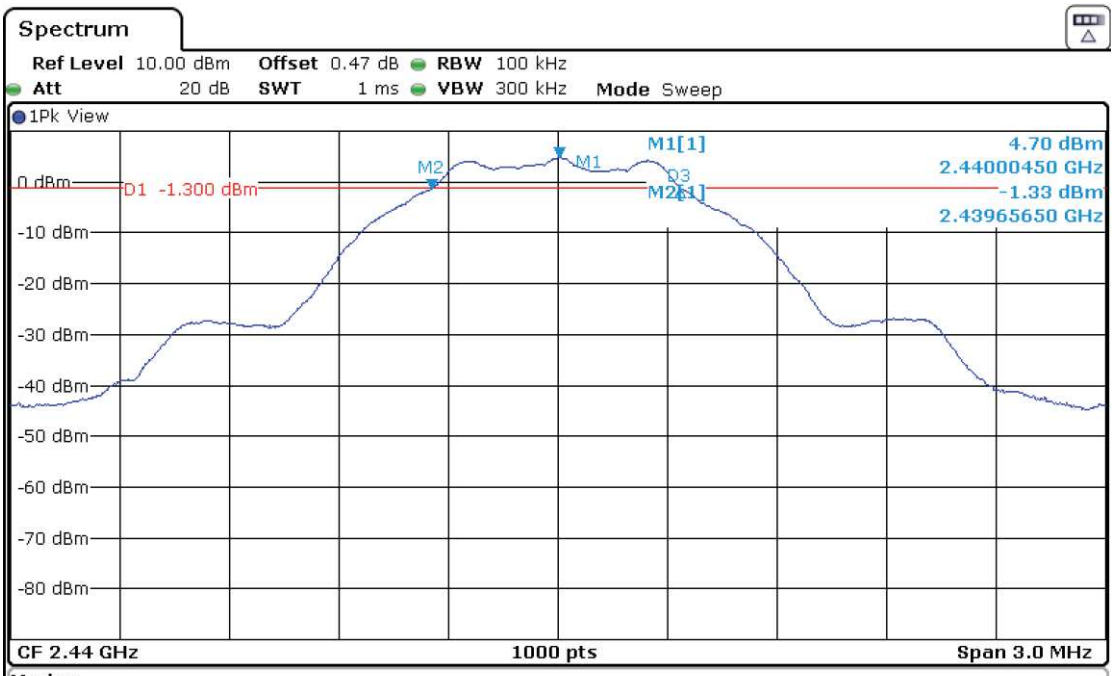
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
6 dB Spectrum Bandwidth (kHz)	681	678	681
Measurement uncertainty (kHz)	<±11.0		

Verdict: PASS

- Low Channel:



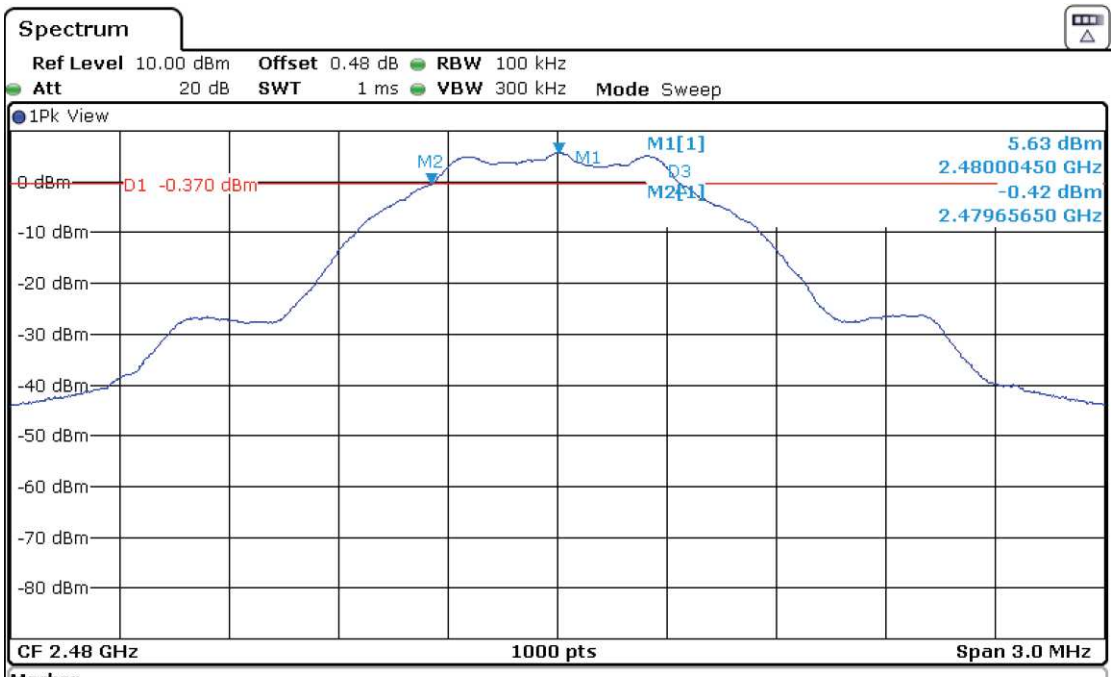
- Middle Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4400045 GHz	4.70 dBm		
M2		1	2.4396565 GHz	-1.33 dBm		
D3	M2	1	678.0 kHz	0.08 dB		

- High Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4800045 GHz	5.63 dBm		
M2		1	2.4796565 GHz	-0.42 dBm		
D3	M2	1	681.0 kHz	-0.01 dB		

FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (d) Maximum output power and antenna gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 ”RBW ≥ DTS bandwidth”f of ANSI C.63.10-2013.

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

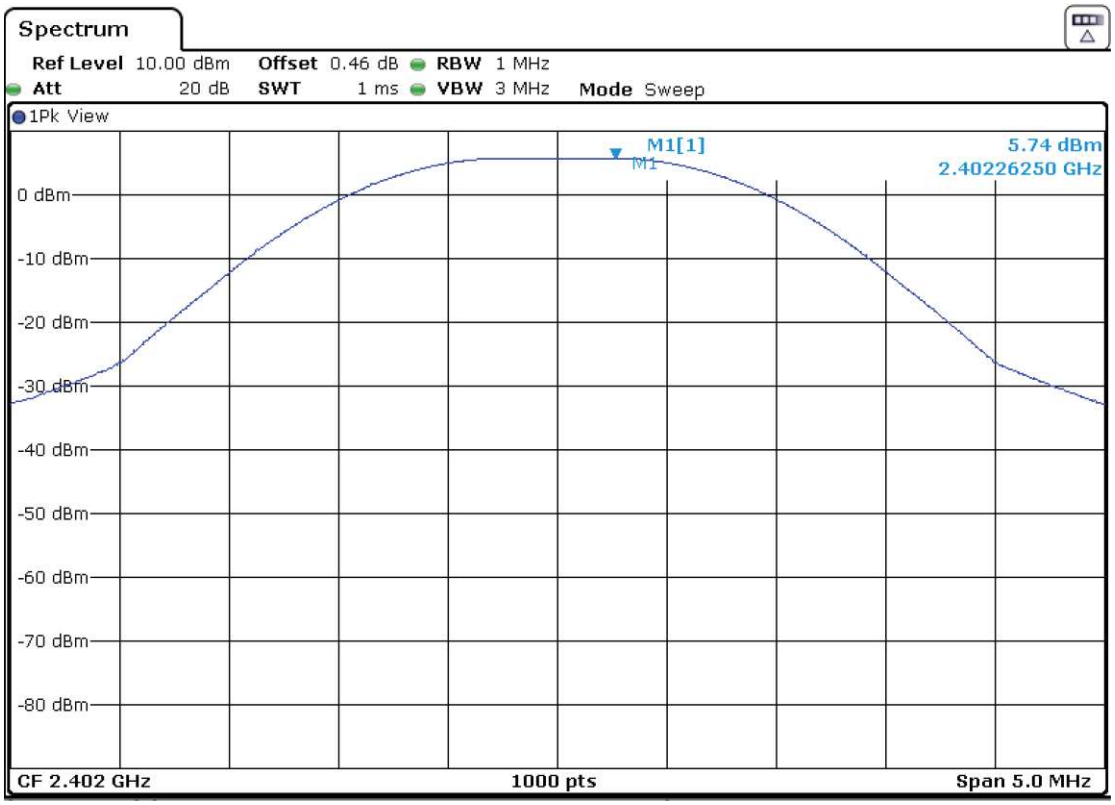
Maximum Declared Antenna Gain: -3 dBi

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	+5.74	+5.10	+5.95
Maximum EIRP Power (dBm)	+2.74	+2.10	+2.95
Measurement uncertainty (dB)	<±1.20		

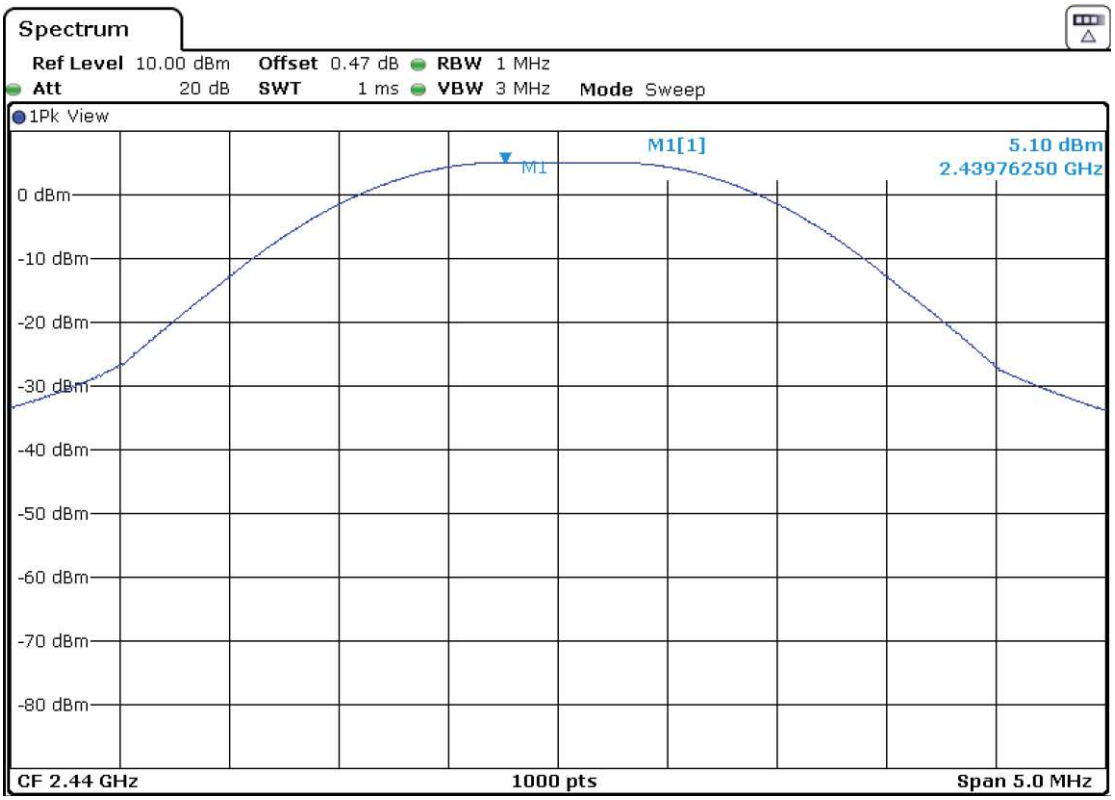
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

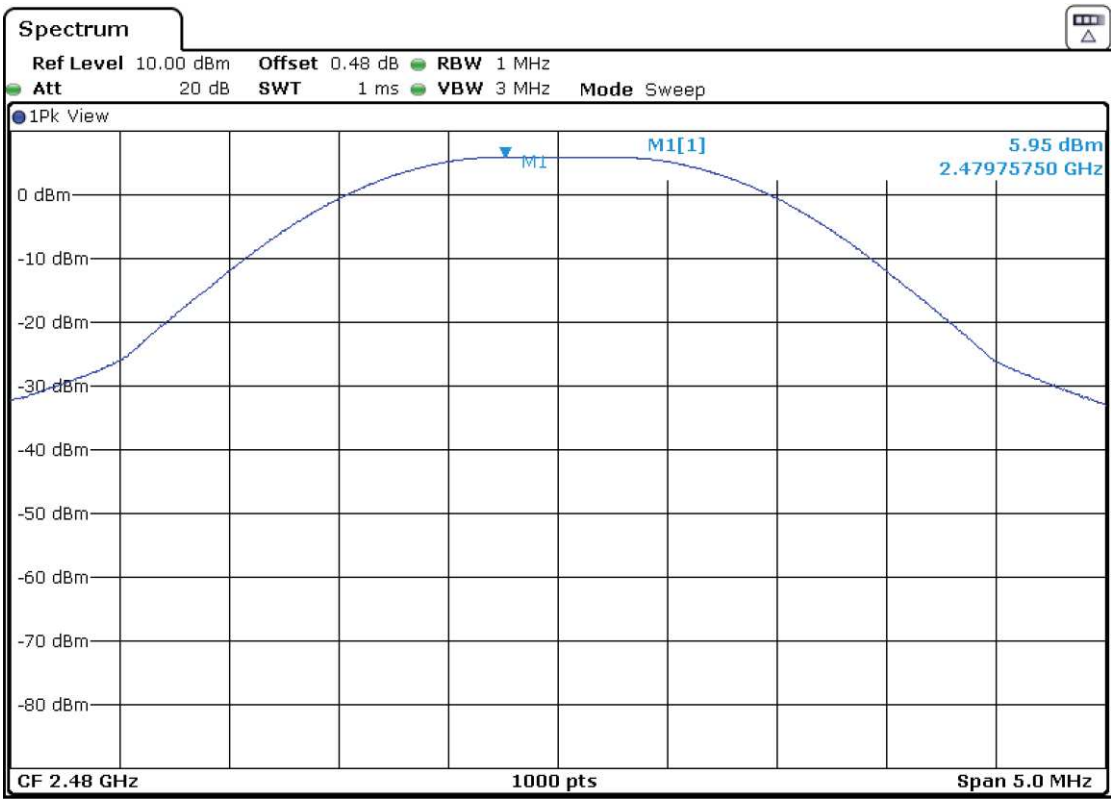
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations conducted (Transmitter)

SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Reference Level Measurement (dBm)	5.4	4.7	5.65
Measurement uncertainty (dB)	<±1.20		

- Low Channel:

No spurious peaks found at less than 20 dB respect to the limit.

- Middle Channel:

No spurious peaks found at less than 20 dB respect to the limit.

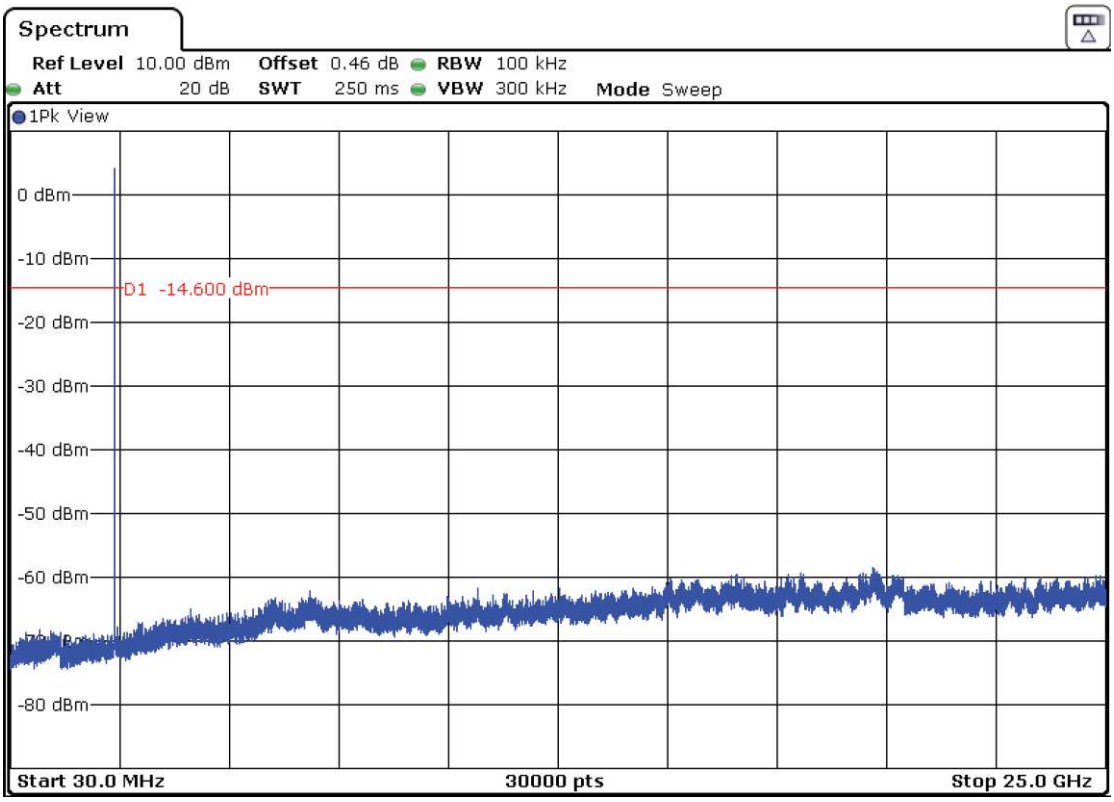
- High Channel:

No spurious peaks found at less than 20 dB respect to the limit.

Measurement uncertainty (dB)	<±1.56

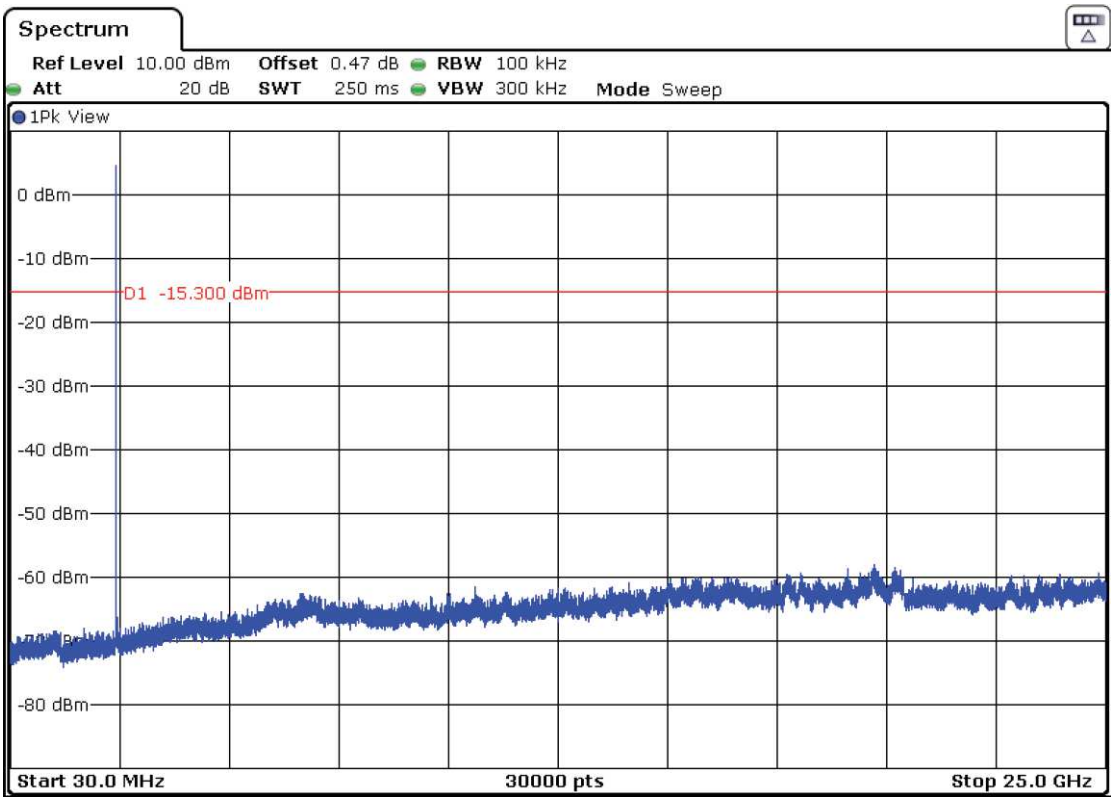
Verdict: PASS

- Low Channel:



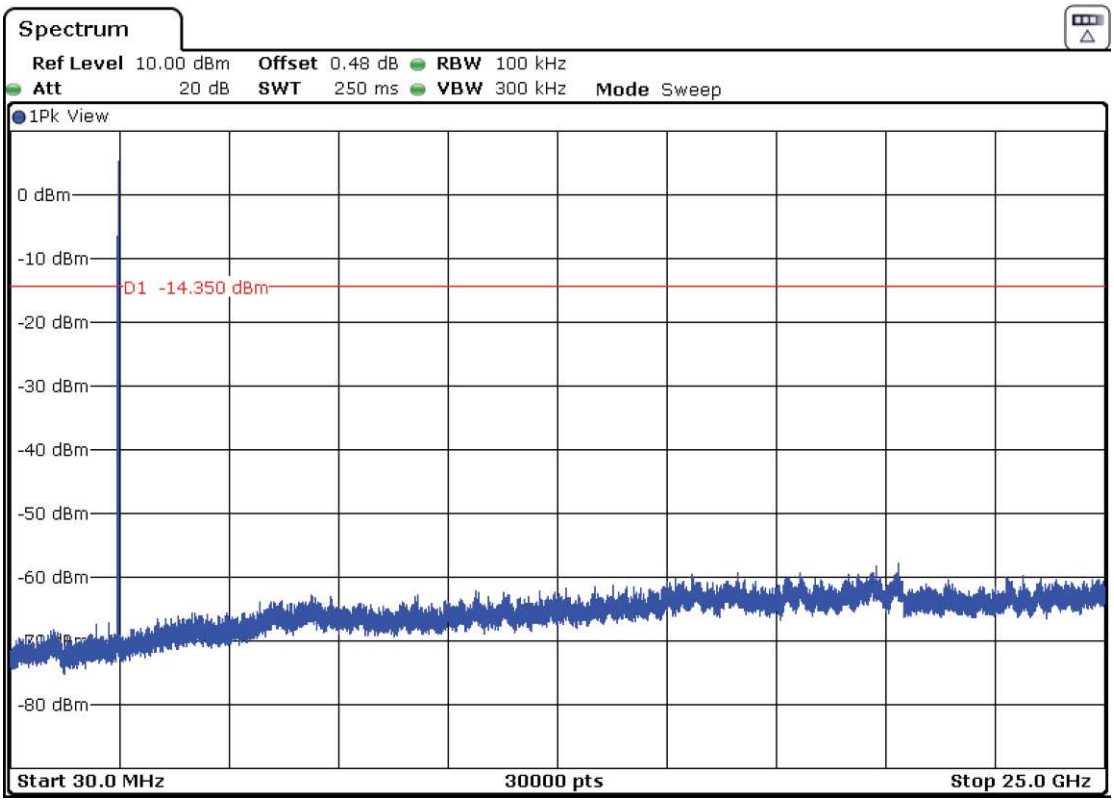
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



The peak shown in the plot above the limit is the carrier frequency.

- High Channel:



The peak shown in the plot above the limit is the carrier frequency.

FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Band-edge emissions compliance (Transmitter)

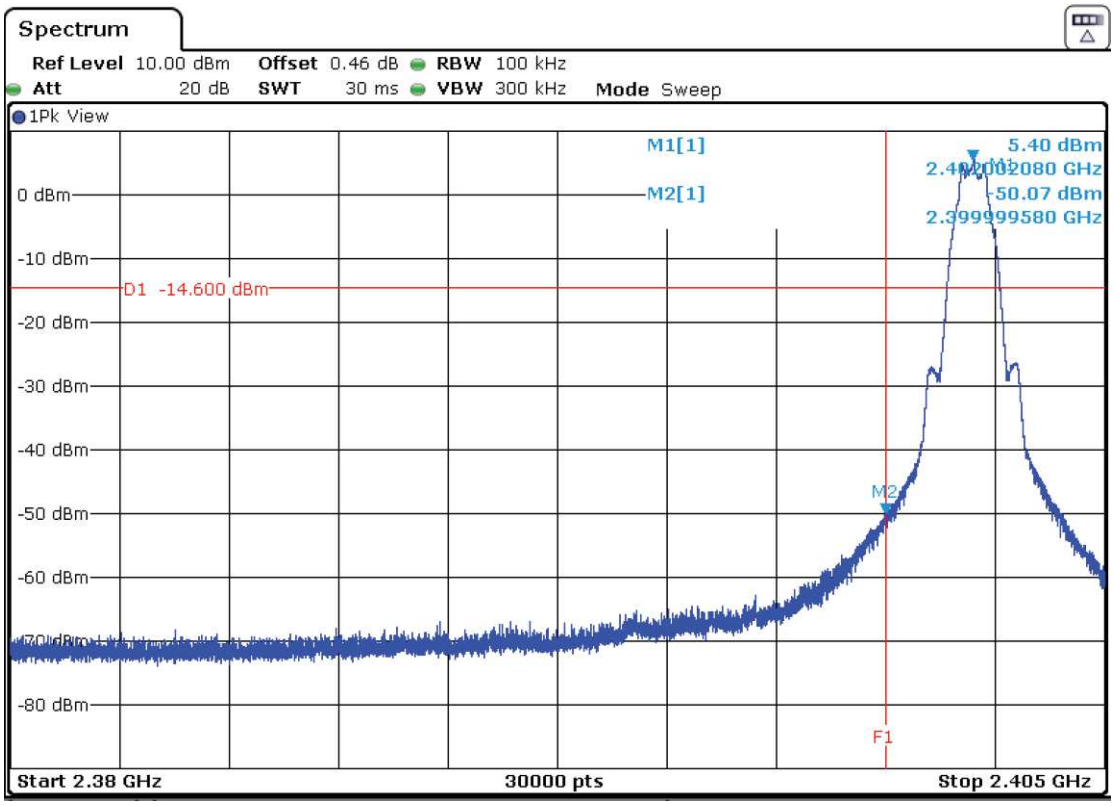
SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

- Low Channel:

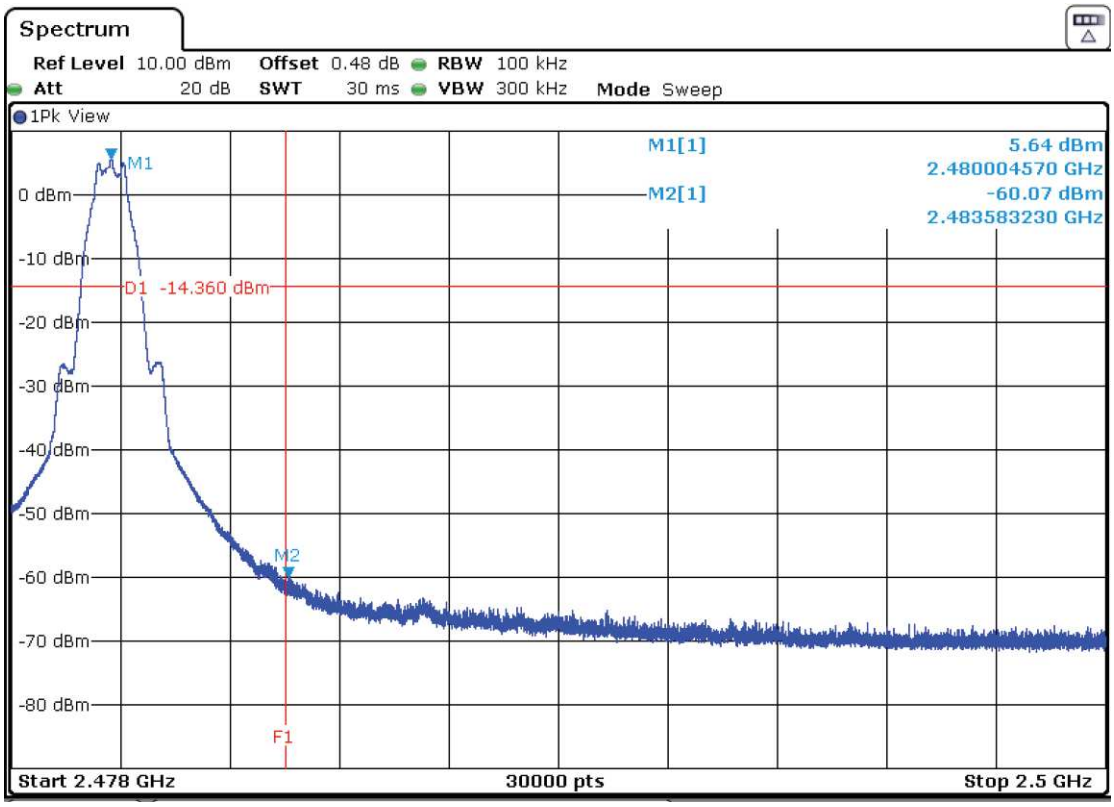
All emissions are more than 20 dB of the limit.



Verdict: PASS

- High Channel:

All band-edge emissions are more than 20 dB of the limit.



Verdict: PASS

Measurement uncertainty (dB)	<±1.56

FCC Section 15.247 Subclause (e) / RSS-247 5.2. (b) Power spectral density

SPECIFICATION:

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.

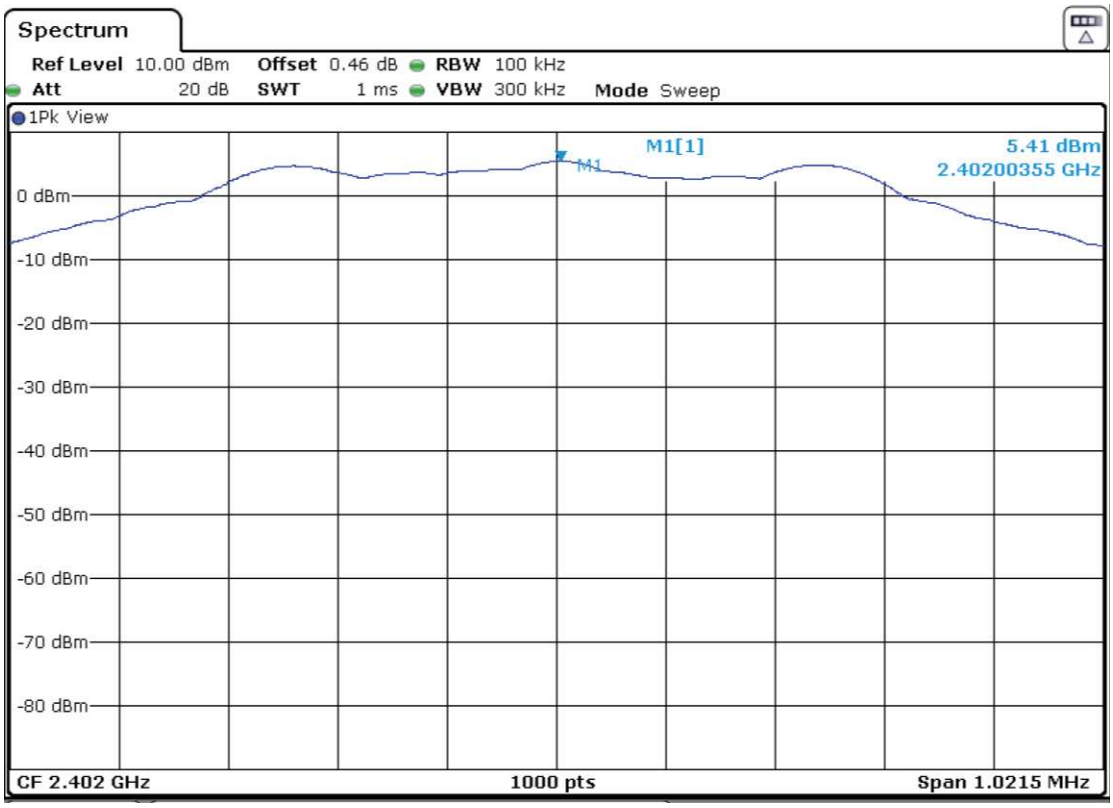
RESULTS:

The maximum power spectral density level in the fundamental emission was measured using the method according to point 11.10.2." Method PKPSD (peak PSD)" of of ANSI C.63.10-2013.

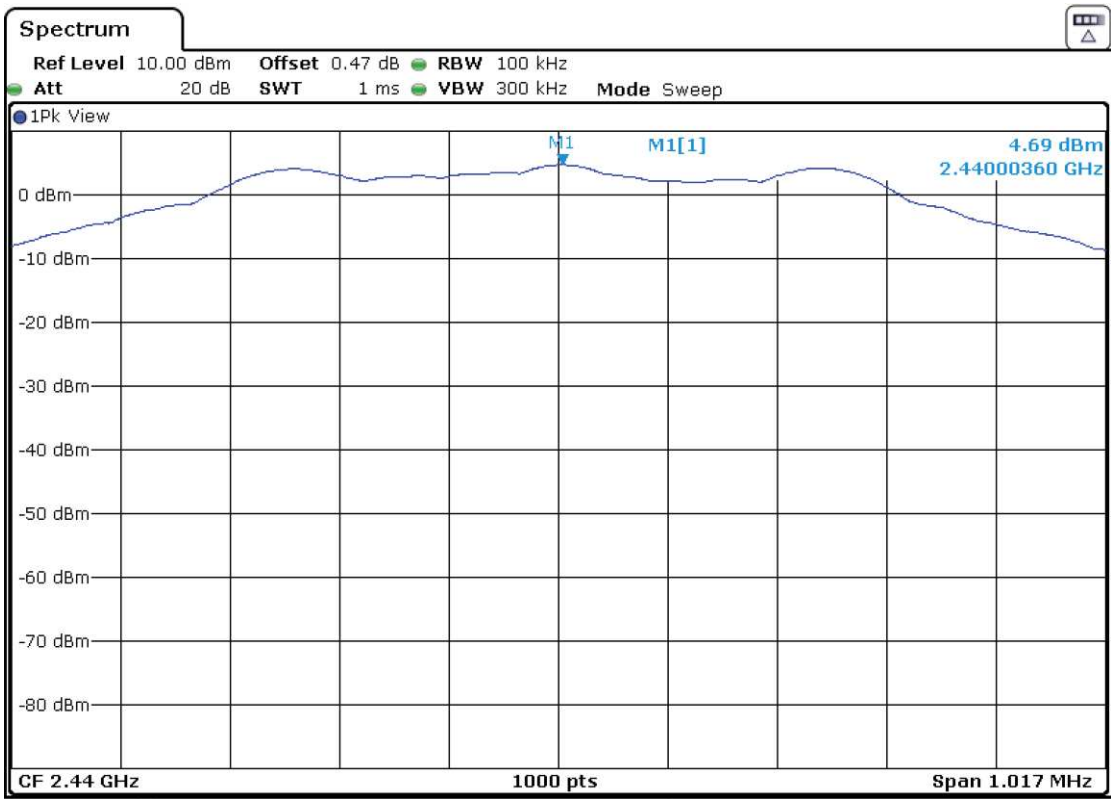
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Peak Power Spectral Density (dBm)	5.41	4.69	5.61
Measurement uncertainty (dB)	<±1.20		

Verdict: PASS

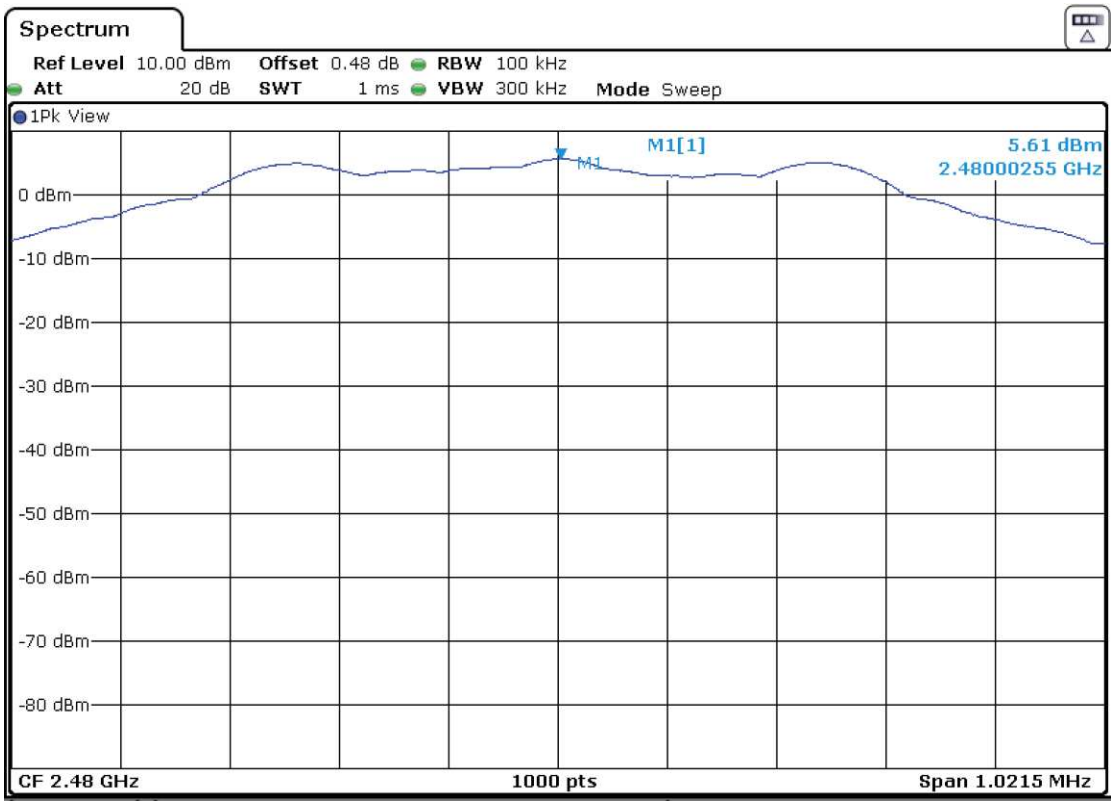
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations radiated (Transmitter)

SPECIFICATION:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 10000	500	54	3

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 corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247: Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz - 1 GHz:

The spurious frequencies detected do not depend on the operating channel.

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
65.163	Quasi peak	+21.3	V	<± 3.81
124.624	Quasi peak	+25.6	V	<± 3.81

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious signals with peak levels above the average limit (54 dBµV/m at 3 m) are measured with average detector for checking compliance with the average limit.

- LOW CHANNEL:

No spurious frequencies at less than 20 dB of the limit.

- MIDDLE CHANNEL:

No spurious frequencies at less than 20 dB of the limit.

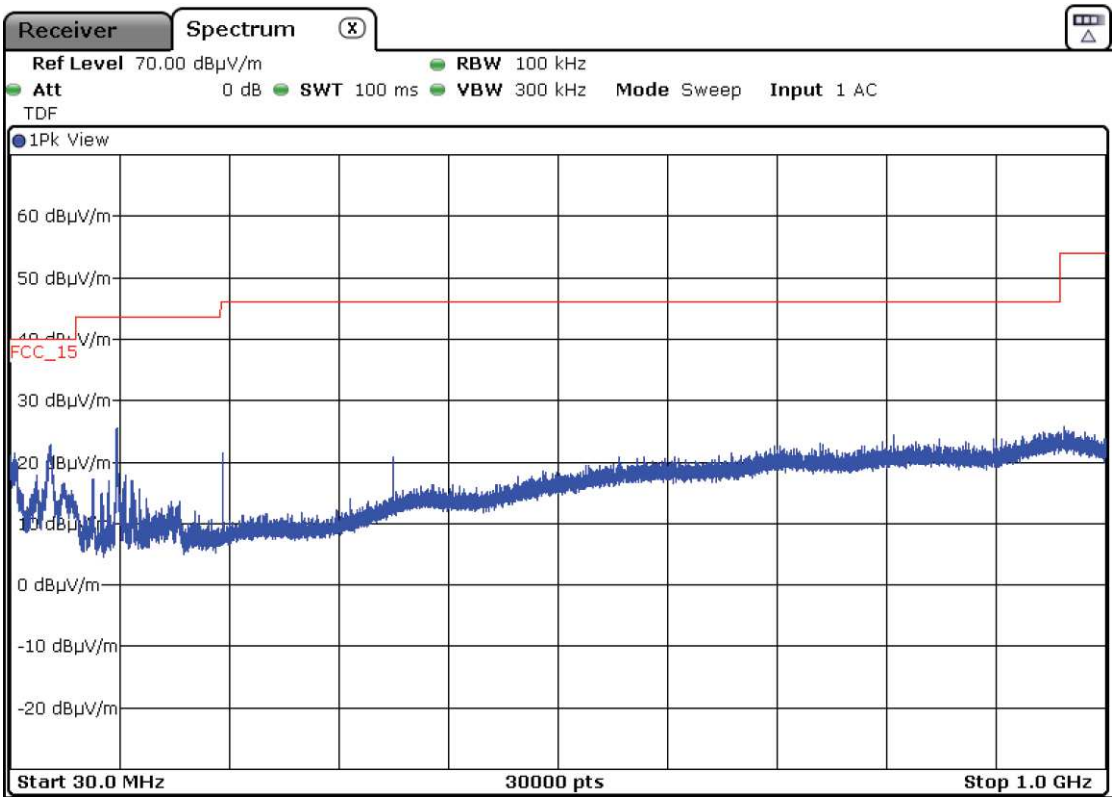
- HIGH CHANNEL:

No spurious frequencies at less than 20 dB of the limit.

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

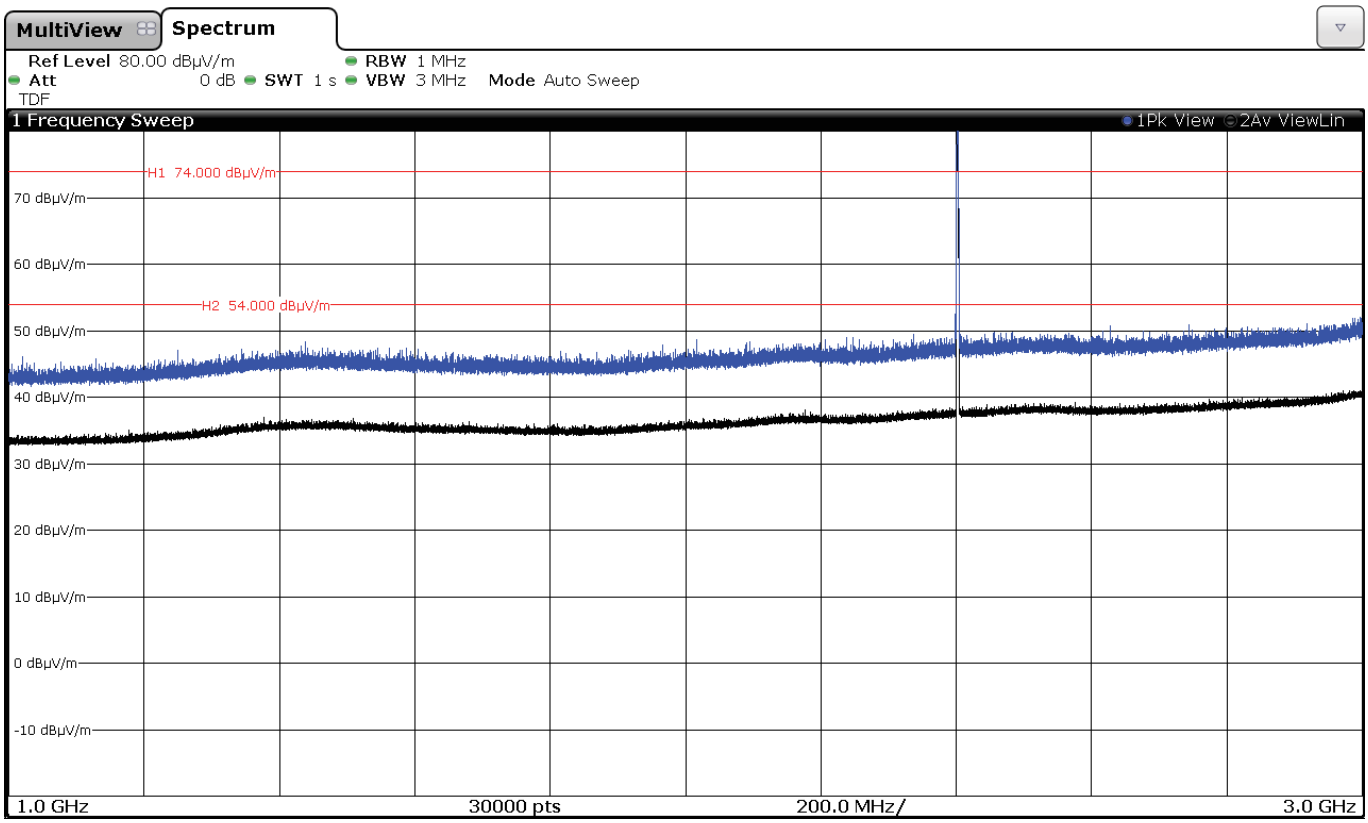
The spurious signals detected do not depend on the operating channel.



This plot is valid for the Low, Middle and High Channels.

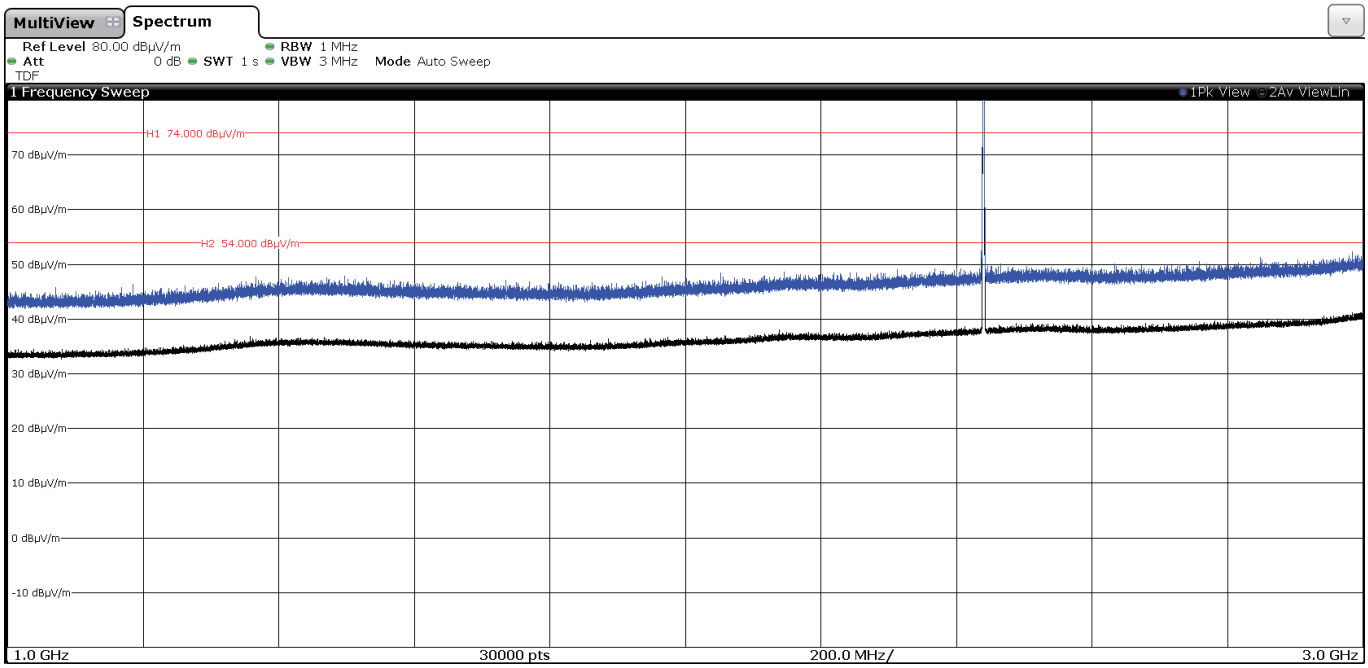
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



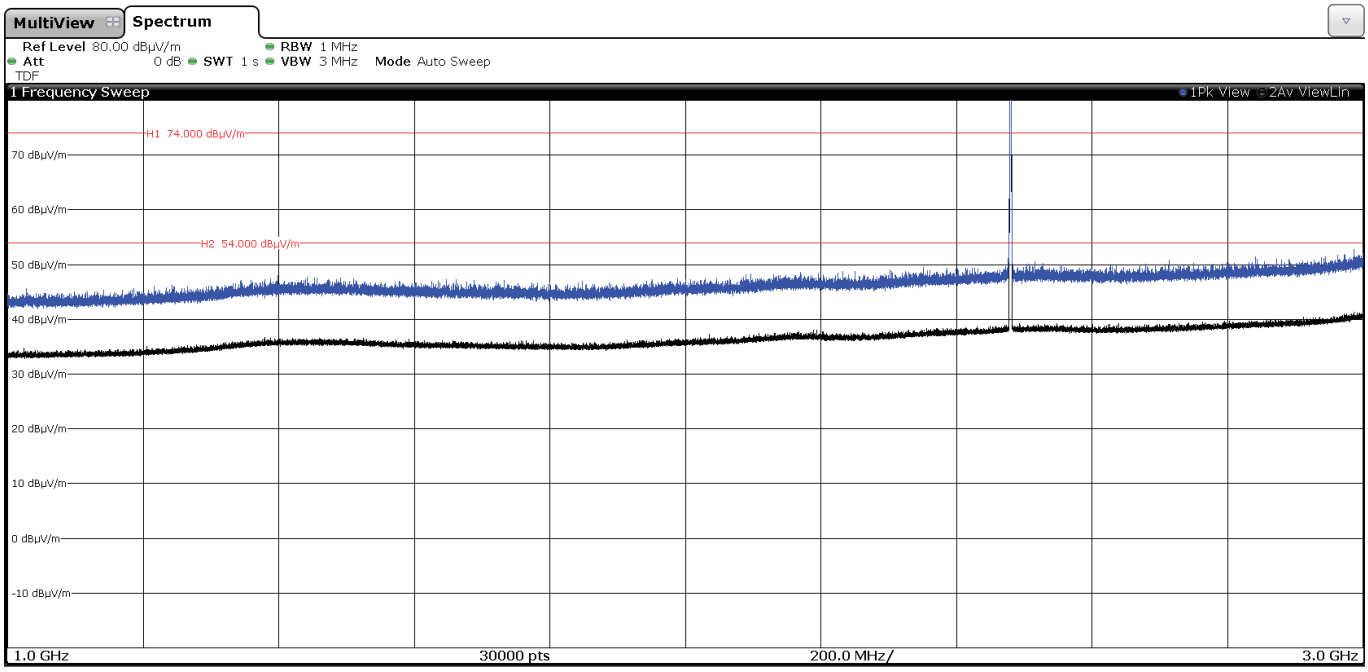
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

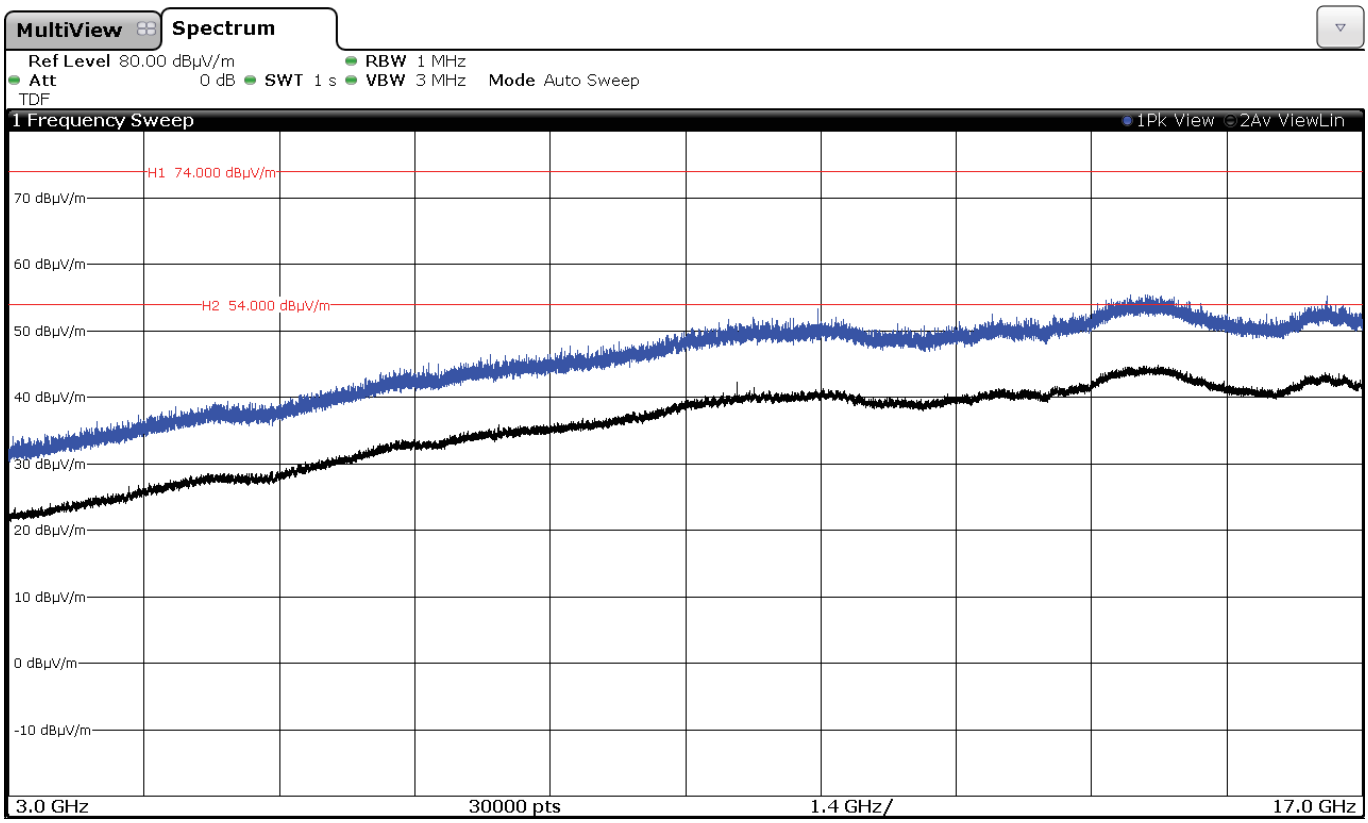
- High Channel:



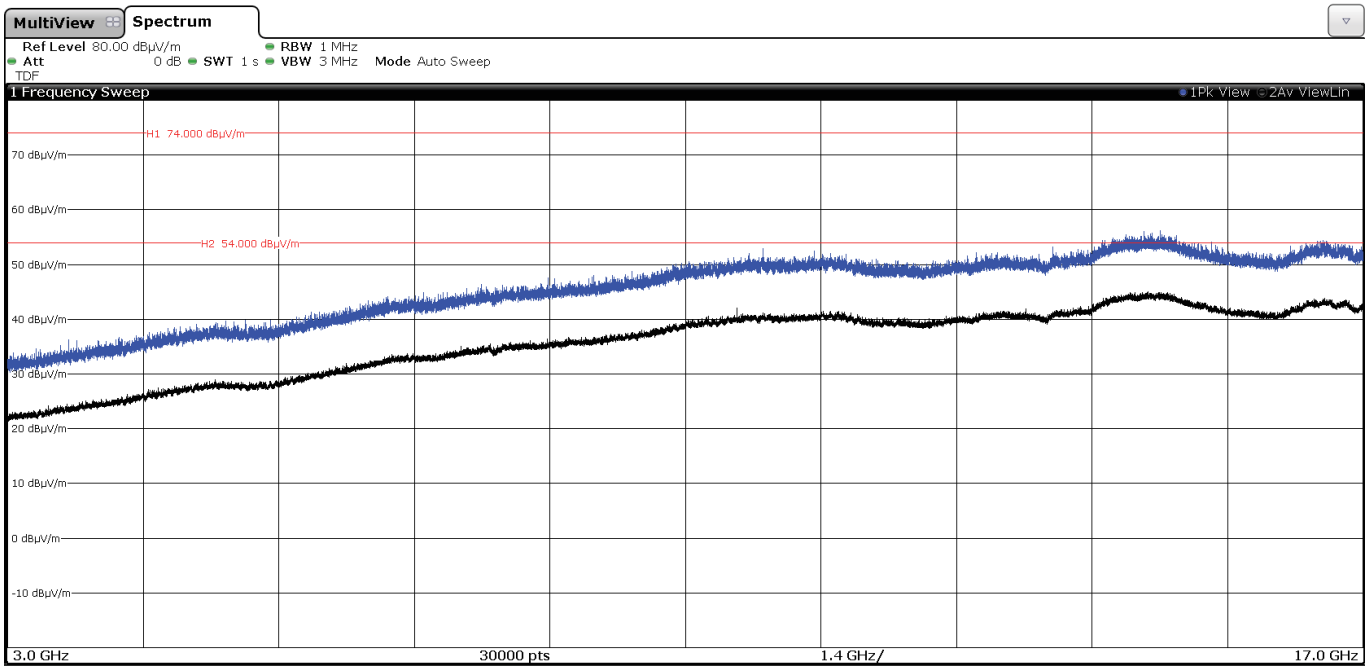
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

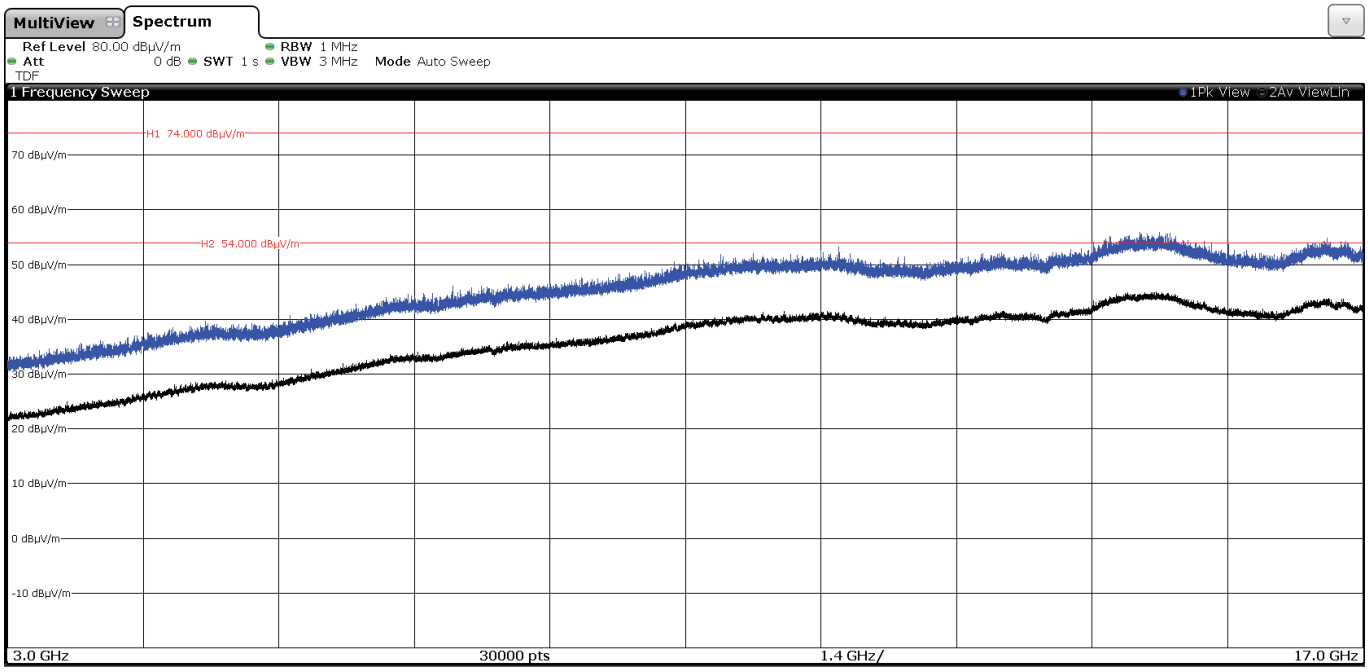
- Low Channel:



- Middle Channel:

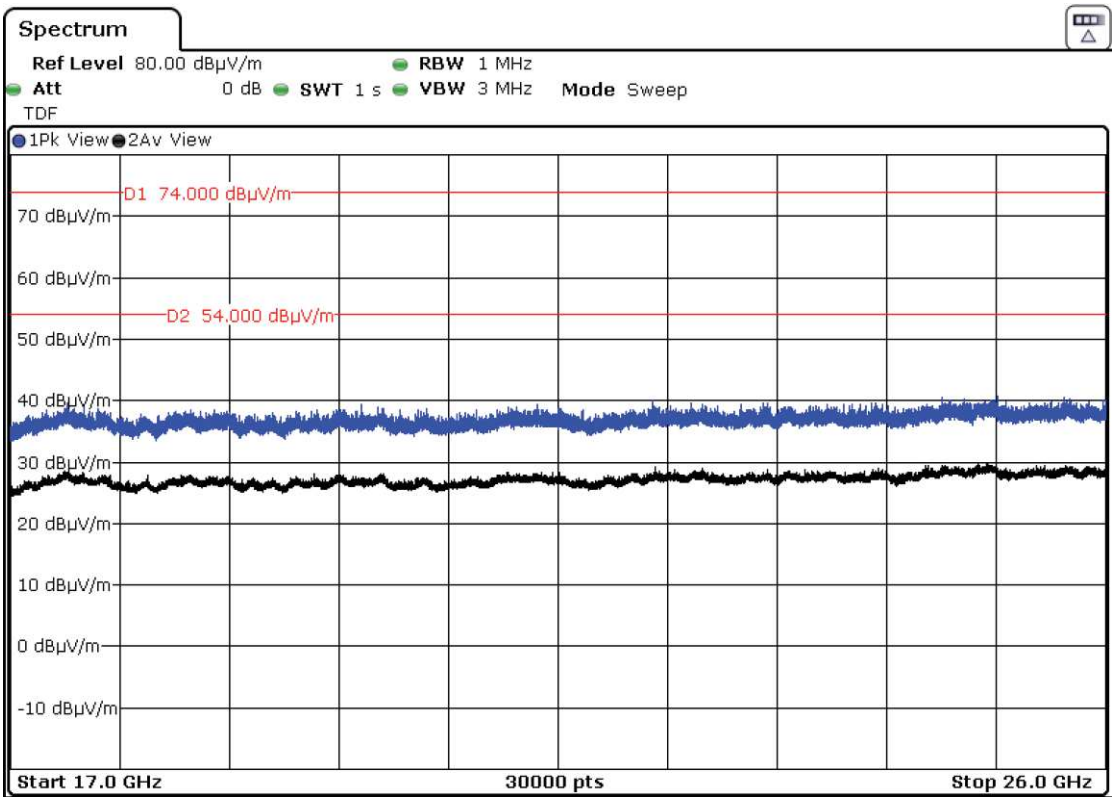


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

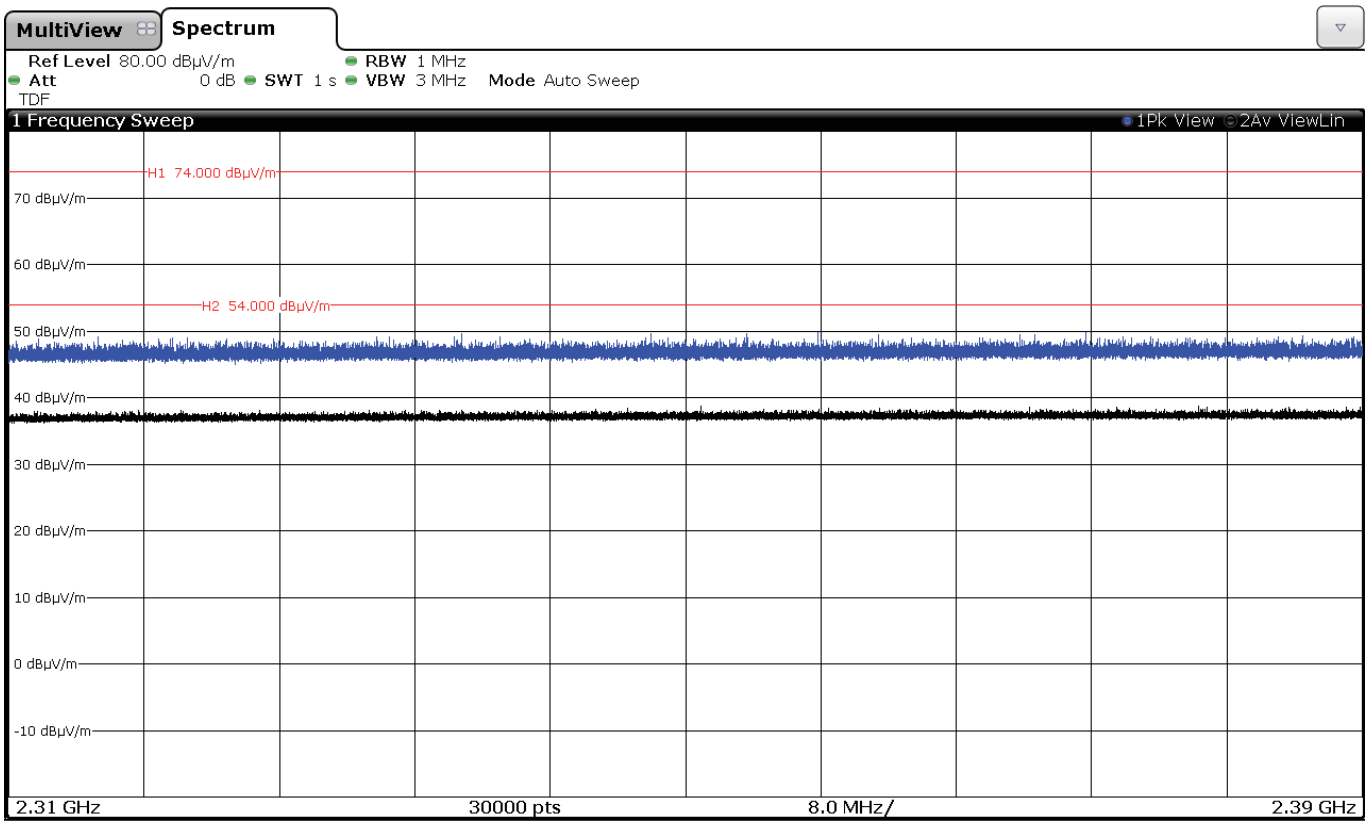
The spurious signals detected do not depend on the operating channel.



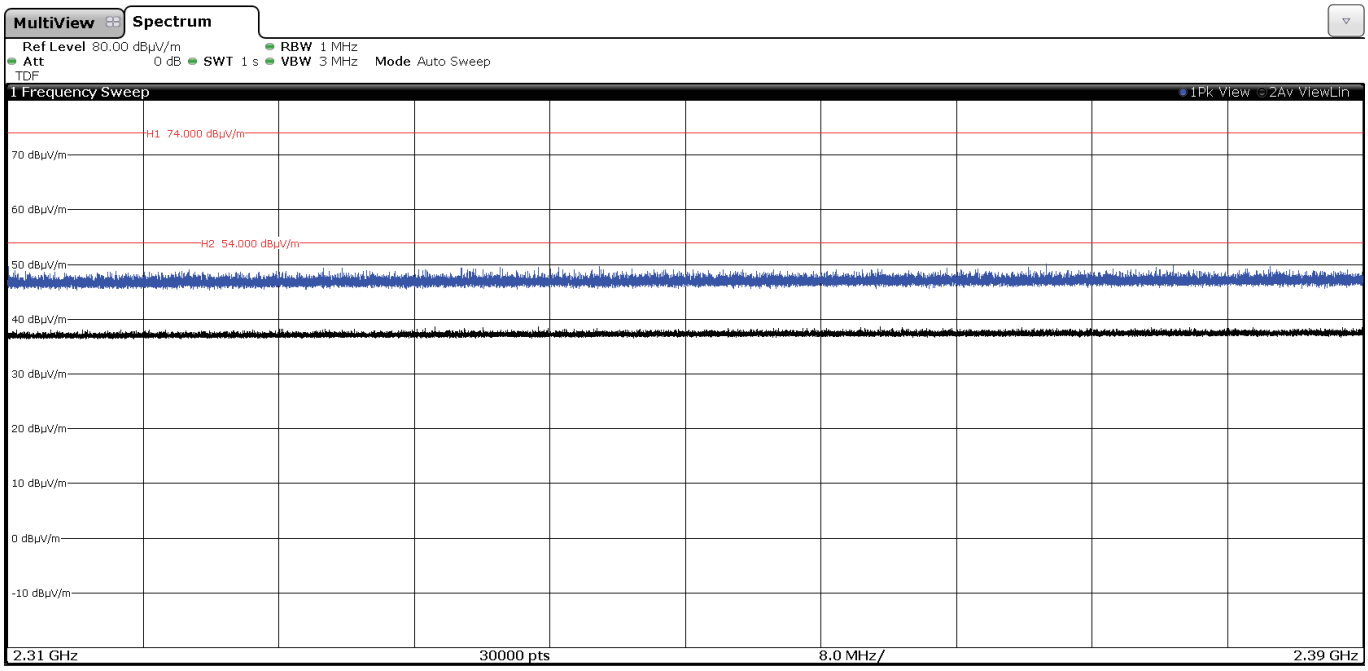
This plot is valid for the Low, Middle and High Channels.

FREQUENCY RANGE 2.31-2.39 GHz:

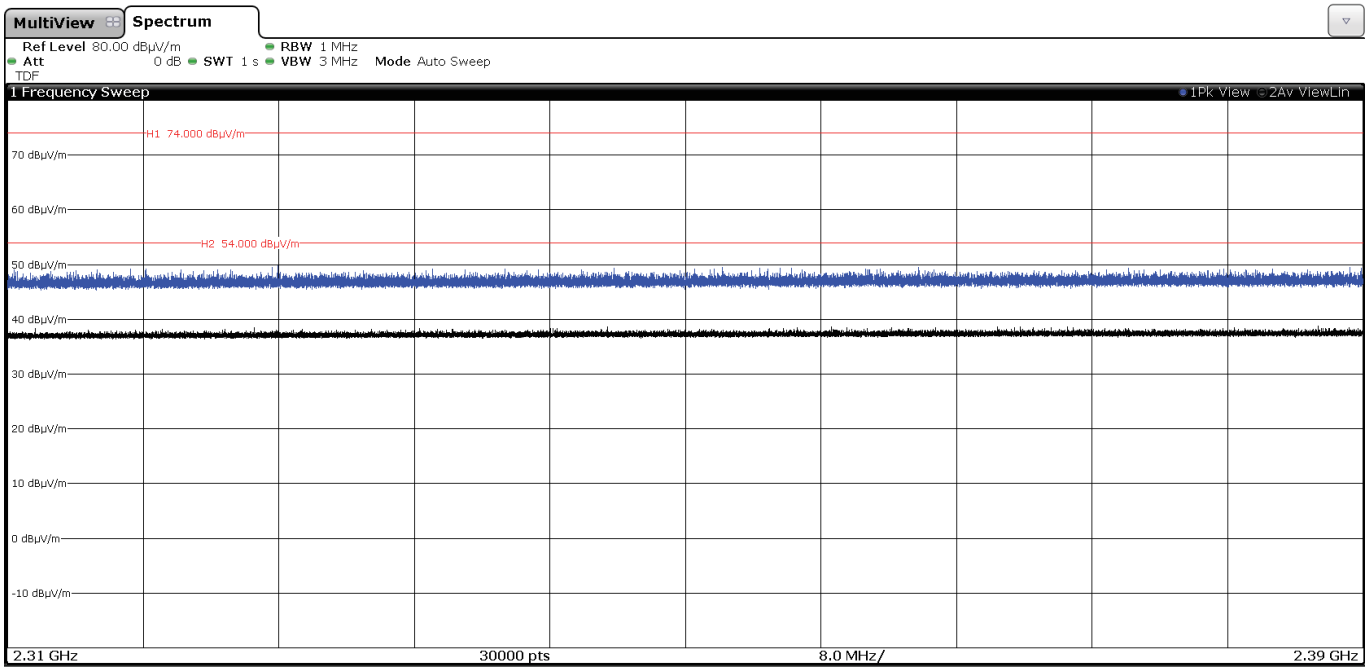
- Low Channel:



- Middle Channel:

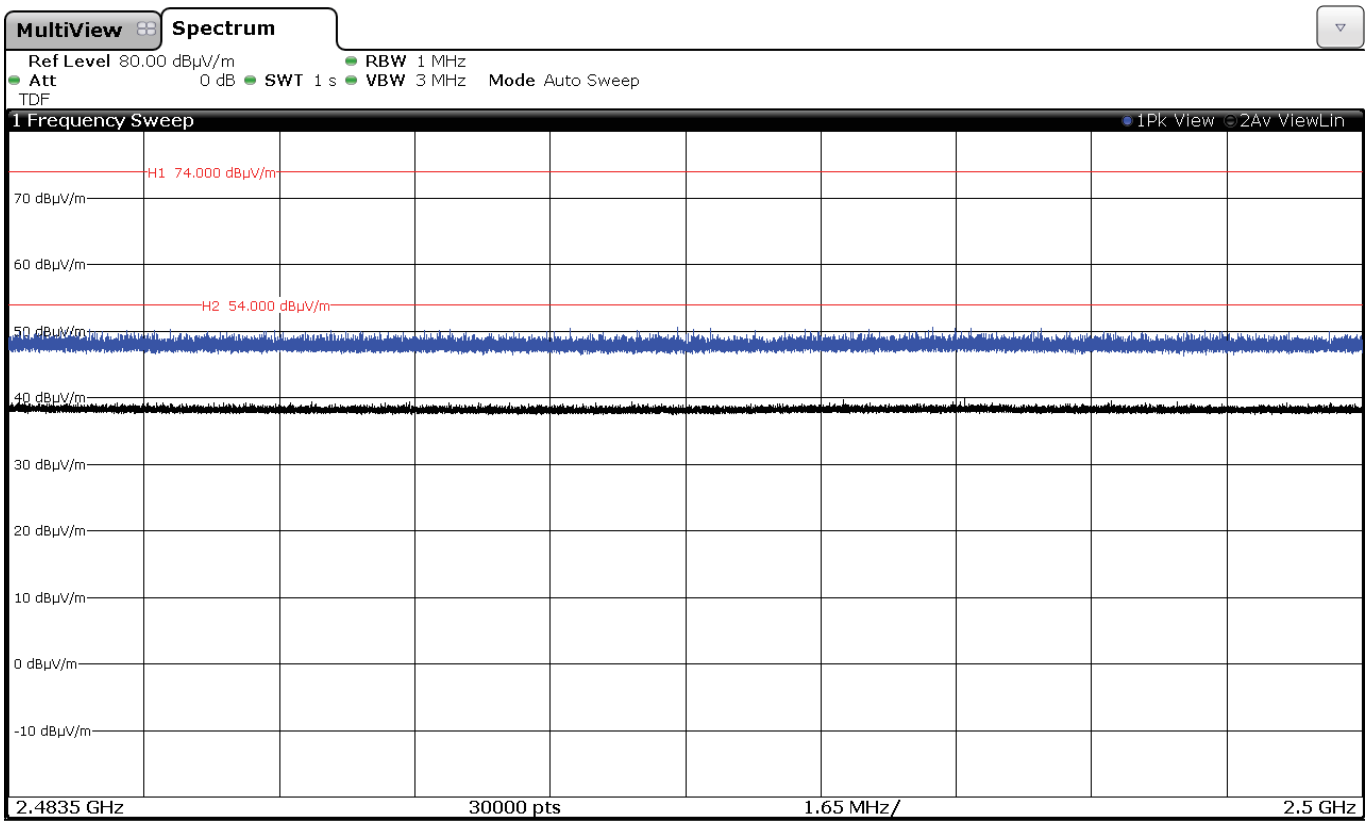


- High Channel:

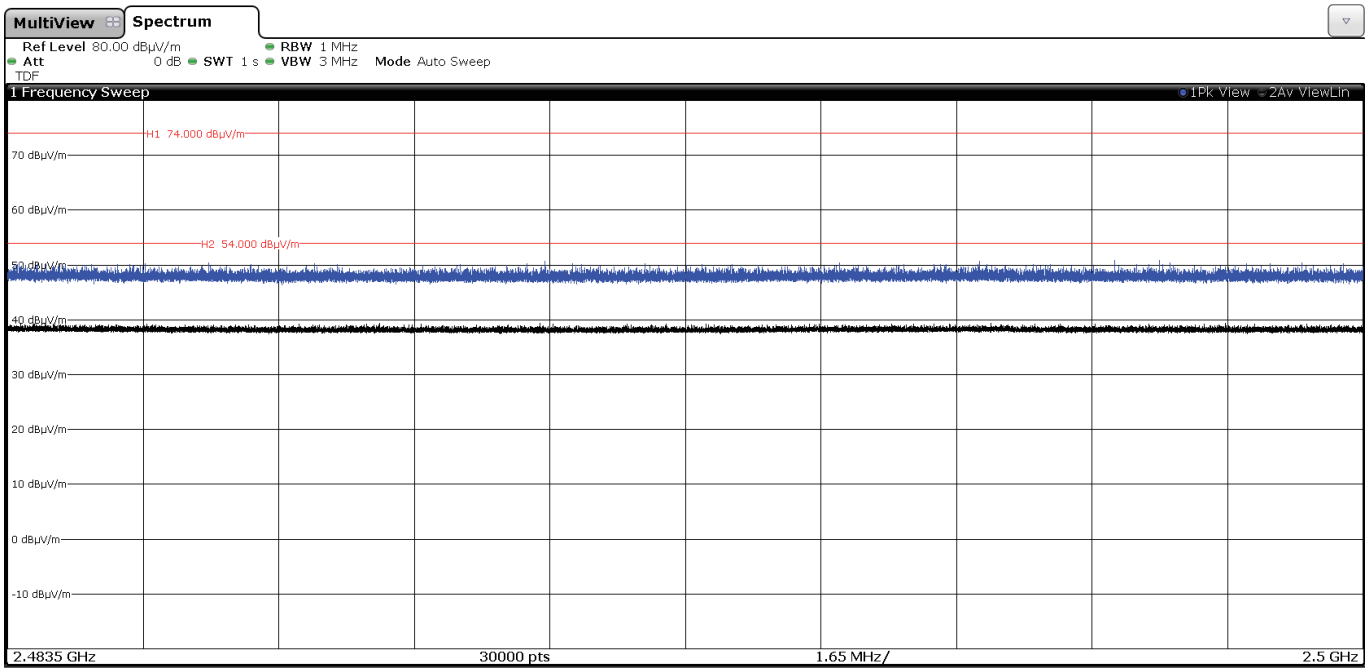


FREQUENCY RANGE 2.4835-2.5 GHz:

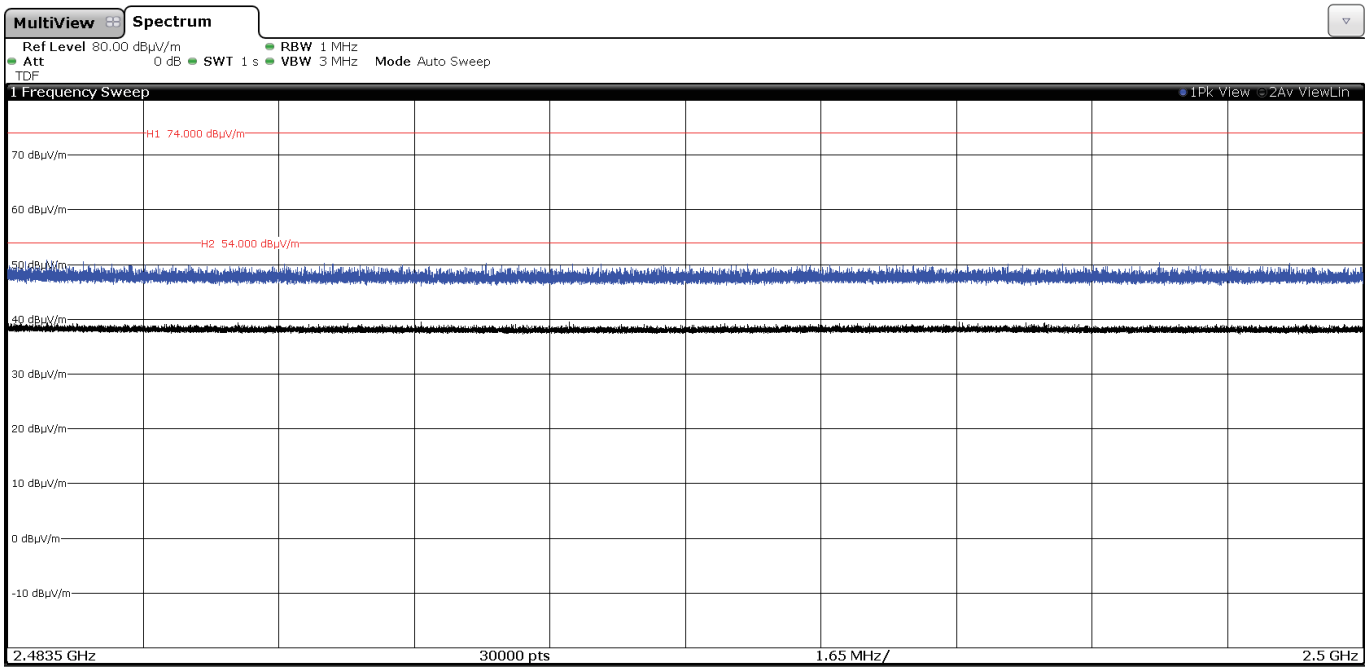
- Low Channel:



- Middle Channel:



- High Channel:



Appendix C: Test results. Wi-Fi bgn2040 2x2.

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TEST CONDITIONS

POWER SUPPLY (V):

V nonimal:	3.8 Vdc
Type of Power Supply:	DC voltage from external power supply.
Type of Antenna:	Internal (Monopole with parasitic resonator).
Antennas Gain:	

- CHAIN0 – Maximum Declared Antenna Gain: -3 dBi
- CHAIN1 – Maximum Declared Antenna Gain: 2.2 dBi
- MIMO – CHAIN0 Antenna & CHAIN1 Antenna.

Directional Antenna Gain Calculations for 2Tx CDD MIMO

- For 2Tx CDD MIMO modes, in accordance with KDB 662911 D01 v02r01 Section F)2)f)(ii), directional gain was calculated as:

Nss= 1, N_{ANT} = 2, G_{CORE1} = -3 dBi, G_{CORE2} = 2.2 dBi

$$\text{Directional Gain} = 10\log\left[\frac{\sum_{j=1}^{N_{SS}}\left(\sum_{k=1}^{N_{ANT}} g_{j,k}\right)^2}{N_{ANT}}\right] = 10\log\left[\frac{\sum_{j=1}^{1}\left(\sum_{k=1}^{3} g_{j,k}\right)^2}{2}\right]$$

$$= 10\log\left[\frac{\left(g_{1,1}+g_{1,2}\right)^2}{2}\right] = 10\log\left[\frac{\left(10^{\frac{G_1}{20}}+10^{\frac{G_2}{20}}\right)^2}{2}\right] = 10\log\left[\frac{\left(10^{\frac{-3}{20}}+10^{\frac{2.2}{20}}\right)^2}{2}\right] = \mathbf{2.99}\ \text{dBi}$$

TEST FREQUENCIES:

For Wi-Fi 802.11b/g/n20:

Low Channel (1):	2412 MHz
Middle Channel (6):	2437 MHz
High Channel (11):	2462 MHz

For Wi-Fi 802.11n40:

Lowest Channel (3):	2422 MHz
Middle Channel (6):	2437 MHz
Highest Channel (9):	2452 MHz

The sample was used to configure the EUT to continuously transmit at a specified output power in all channels with different modes and modulation schemes.

WiFi 2.4 GHz	WIFI Tool: TX Power (dBm)	
	SiSo	MiMo
802.11b	15	14
802.11g	14.5	14
802.11n20	14.5	14
802.11n40	13.5	10

The field strength at the band edges was evaluated for each mode for the channel under test.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes.

The EUT has two separate antennas which correspond to three separate antenna ports.

For the Transmitter Minimum 6 dB Bandwidth test, only SISO modes were tested since the bandwidth does not change depending on chains used.

The client supplied U.FL RF cables with the EUT in order to perform conducted measurements. The measured additional path loss was included in any path loss calculations.

The data rates of 1Mb/s for 802.11b, 6.5Mb/s for 802.11g, MSC0 for 802.11n20, MSC0 for 802.11n40 were selected based on preliminary testing that identified those rates corresponding to the worst cases for output power and band edge levels at restricted bands.

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyzer.

RADIATED MEASUREMENTS

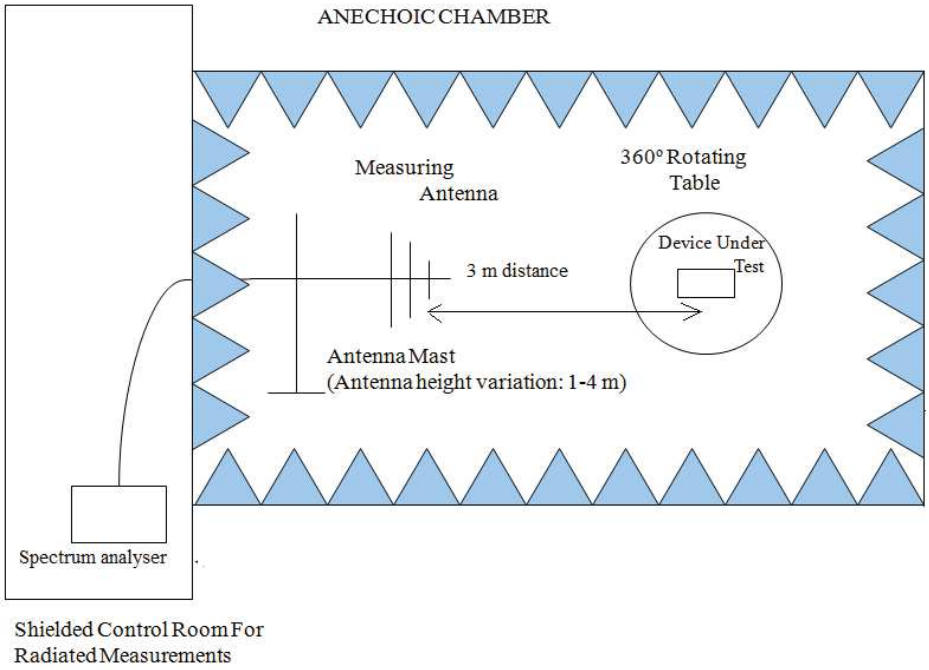
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1 m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

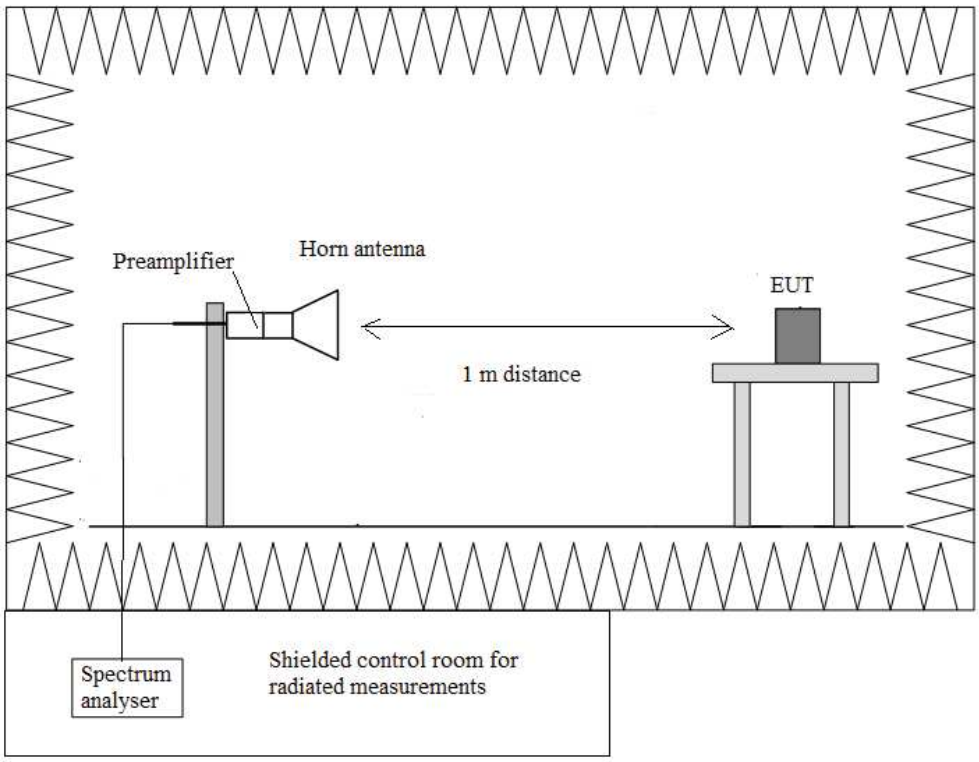
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup f < 1 GHz



Radiated measurements setup f > 1 GHz:



Occupied Bandwidth

RESULTS:

Preliminary tests determined the SISO worst case is CHAIN1 Antenna.

CHAIN1 – Antenna:

- **Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	14.37	14.49	13.77
-26 dBc bandwidth (MHz)	18.33	18.78	18.21
Measurement uncertainty (kHz)	<± 18.02		

- **Mode 802.11 g**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	16.95	16.95	16.5
-26 dBc bandwidth (MHz)	24.25	24.70	22.45
Measurement uncertainty (kHz)	<± 28.03		

- **Mode 802.11 n20**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	18.08	17.96	17.88
-26 dBc bandwidth (MHz)	27.08	25.44	25
Measurement uncertainty (kHz)	<± 23.02		

- **Mode 802.11 n40**

	Low Channel 2422 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	36.32	36.32	36.56
-26 dBc bandwidth (MHz)	41.84	41.92	42.56
Measurement uncertainty (kHz)	<± 50.04		

MIMO – CHAIN0 Antenna & CHAIN1 Antenna:

- **Mode 802.11 b**

	Low Channel 2412 MHz		Middle Channel 2437 MHz		High Channel 2462 MHz	
	CHAIN0	CHAIN1	CHAIN0	CHAIN1	CHAIN0	CHAIN1
99% bandwidth (MHz)	13.95	13.83	13.80	14.10	13.92	13.62
-26 dBc bandwidth (MHz)	18.24	17.85	17.82	18.30	18.24	18.18
Measurement uncertainty (kHz)	<± 18.02					

- **Mode 802.11 g**

	Low Channel 2412 MHz		Middle Channel 2437 MHz		High Channel 2462 MHz	
	CHAIN0	CHAIN1	CHAIN0	CHAIN1	CHAIN0	CHAIN1
99% bandwidth (MHz)	16.89	16.83	16.71	16.71	16.77	16.56
-26 dBc bandwidth (MHz)	24.59	23.68	22.25	22.98	23.17	22.78
Measurement uncertainty (kHz)	<± 18.02					

- **Mode 802.11 n20**

	Low Channel 2412 MHz		Middle Channel 2437 MHz		High Channel 2462 MHz	
	CHAIN0	CHAIN1	CHAIN0	CHAIN1	CHAIN0	CHAIN1
99% bandwidth (MHz)	18.16	18.12	17.84	18.16	17.96	17.64
-26 dBc bandwidth (MHz)	26.84	27.24	23.40	27	25.52	23.12
Measurement uncertainty (kHz)	<± 23.02					

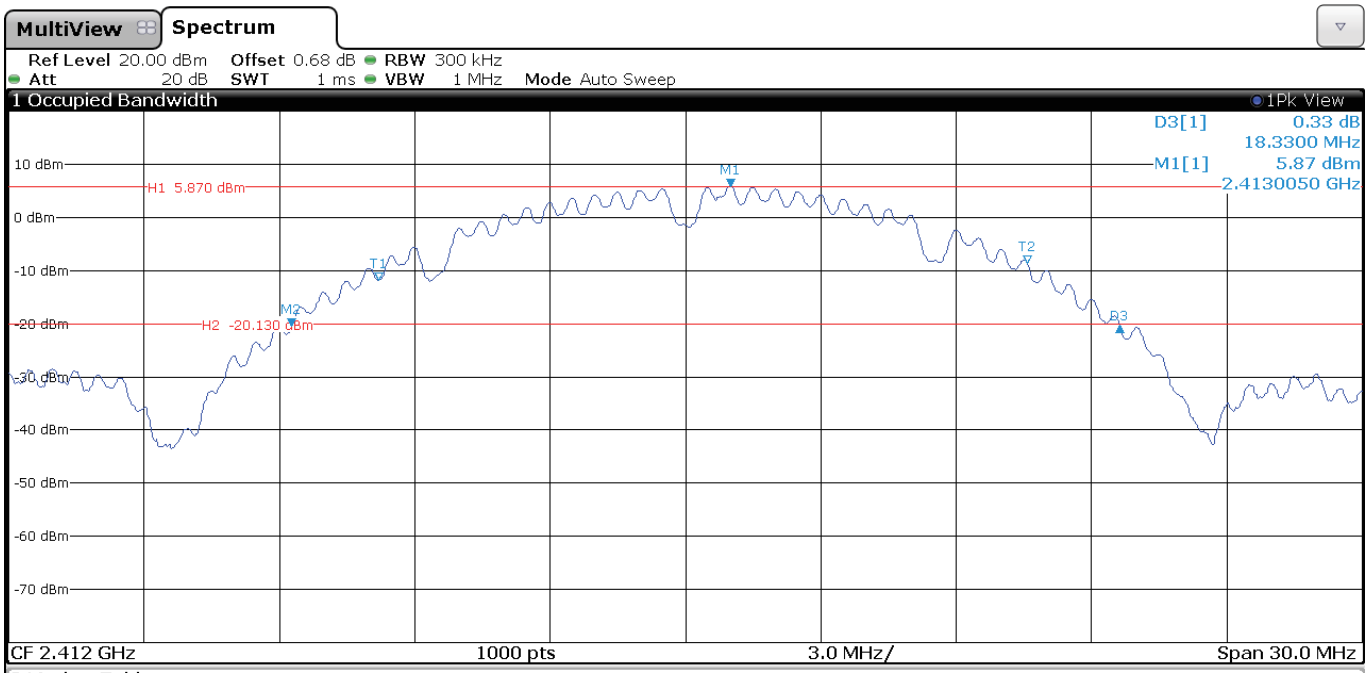
- **Mode 802.11 n40**

	Low Channel 2422 MHz		Middle Channel 2437 MHz		High Channel 2462 MHz	
	CHAIN0	CHAIN1	CHAIN0	CHAIN1	CHAIN0	CHAIN1
99% bandwidth (MHz)	36.18	36.12	36.18	36.12	36.42	36.24
-26 dBc bandwidth (MHz)	41.33	40.98	41.39	41.22	42.47	41.75
Measurement uncertainty (kHz)	<± 35.03					

CHAIN 1 – Antenna:

- **Mode 802.11 b – Occupied Bandwidth**

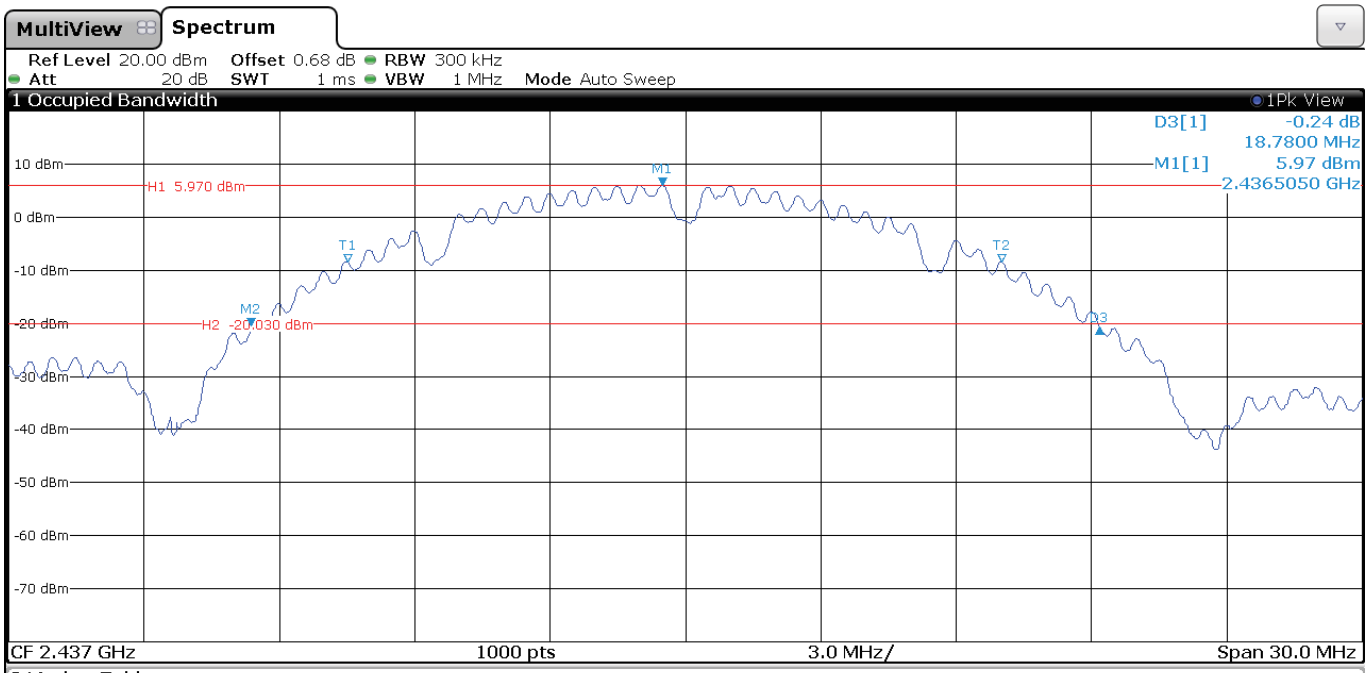
- Low Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.413005 GHz**	**5.87 dBm**		
T1		1	2.405205 GHz	-11.80 dBm	Occ Bw	**14.37 MHz**
T2		1	2.419575 GHz	-8.75 dBm		
M2		1	**2.403285 GHz**	**-20.52 dBm**		
D3	M2	1	**18.33 MHz**	**0.33 dB**		

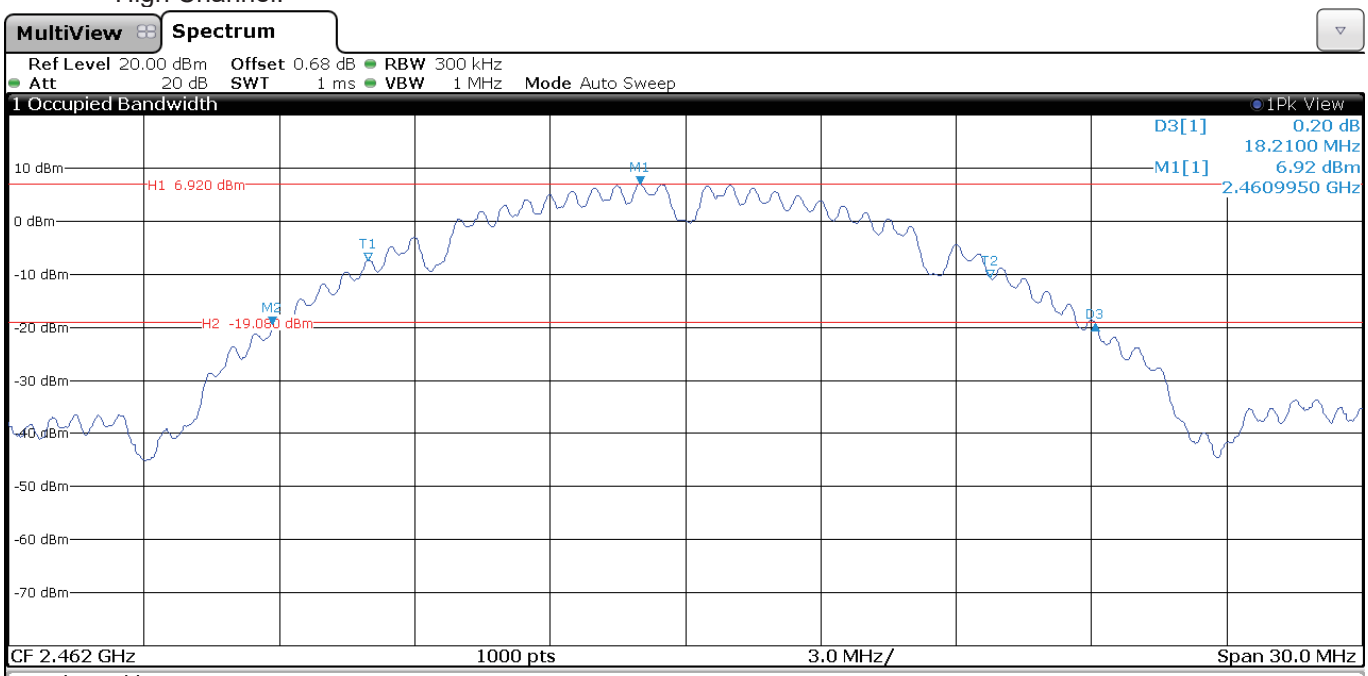
- Middle Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.436505 GHz**	**5.97 dBm**		
T1		1	2.429515 GHz	-8.45 dBm	Occ Bw	**14.49 MHz**
T2		1	2.444005 GHz	-8.52 dBm		
M2		1	**2.427385 GHz**	**-20.40 dBm**		
D3	M2	1	**18.78 MHz**	**-0.24 dB**		

- High Channel:

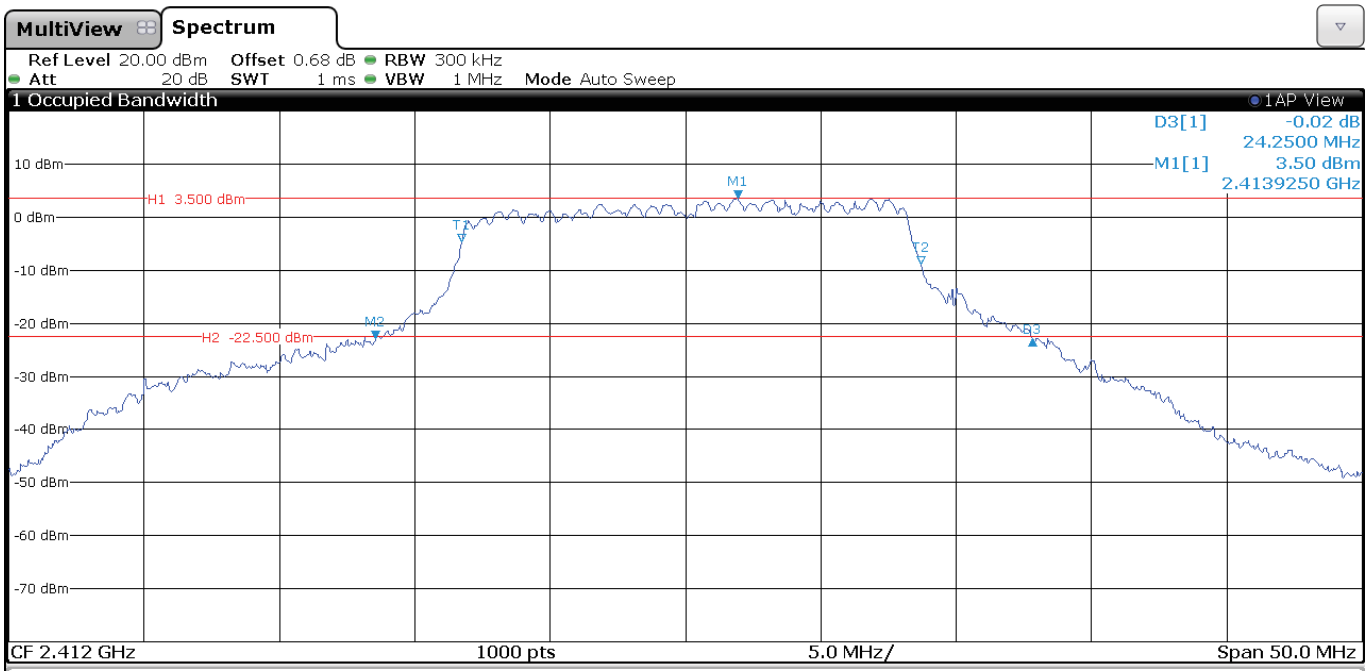


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.460995 GHz**	**6.92 dBm**		
T1		1	2.454965 GHz	-7.40 dBm	Occ Bw	**13.77 MHz**
T2		1	2.468735 GHz	-10.70 dBm		
M2		1	**2.452865 GHz**	**-19.42 dBm**		
D3	M2	1	**18.21 MHz**	**0.20 dB**		

- **Mode 802.11 g – Occupied Bandwidth**

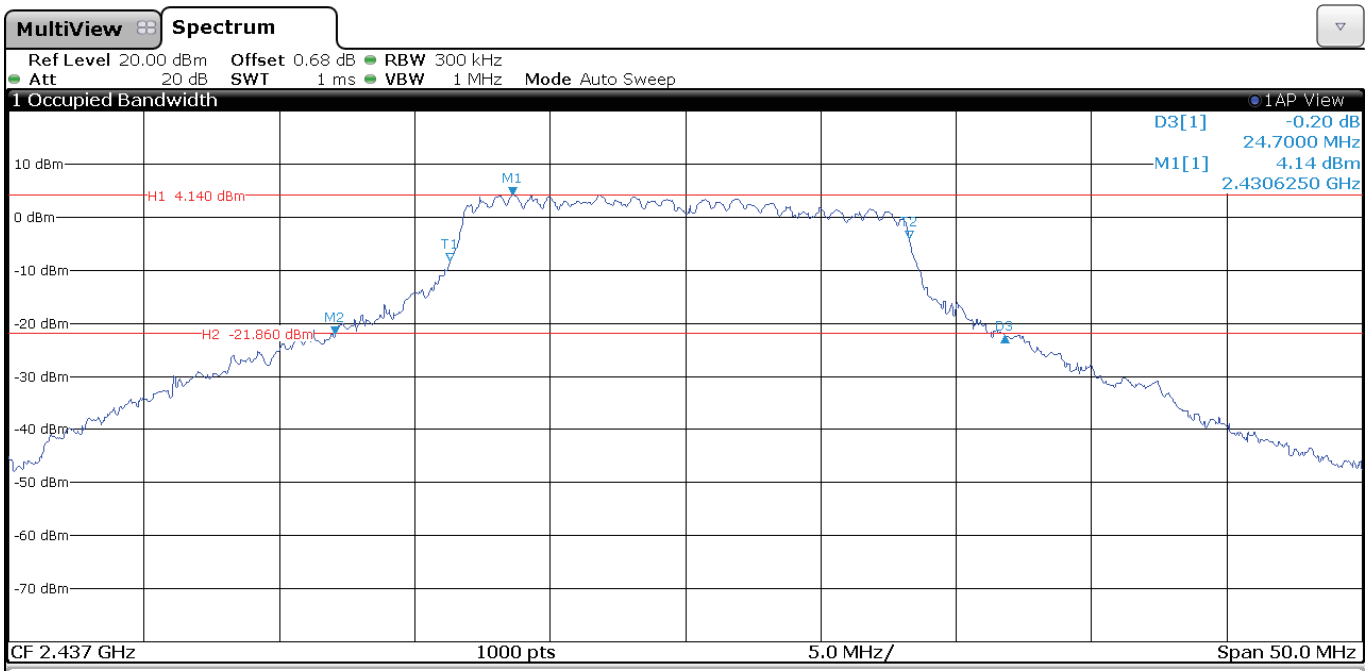
- Low Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.413925 GHz**	**3.50 dBm**		
T1		1	2.403725 GHz	-4.70 dBm	Occ Bw	**16.95 MHz**
T2		1	2.420675 GHz	-8.81 dBm		
M2		1	**2.400575 GHz**	**-22.92 dBm**		
D3	M2	1	**24.25 MHz**	**-0.02 dB**		

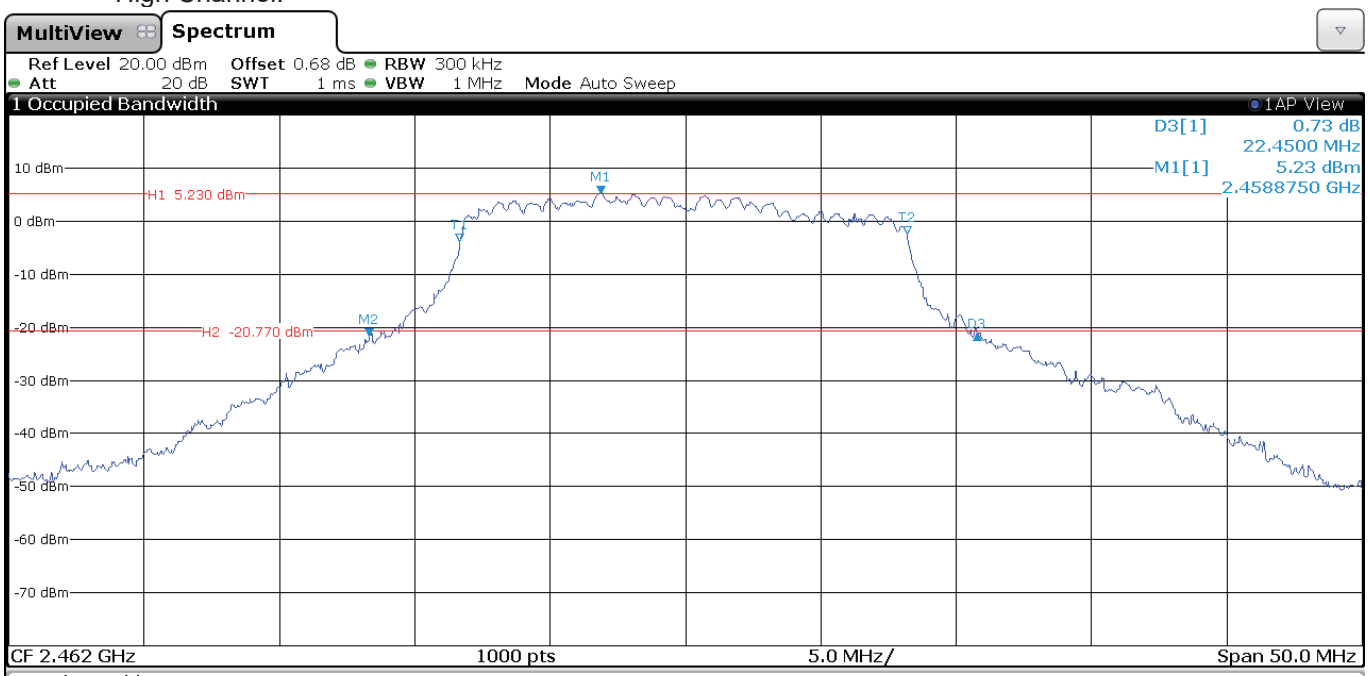
- Middle Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.430625 GHz**	**4.14 dBm**		
T1		1	2.428325 GHz	-8.16 dBm	Occ Bw	**16.95 MHz**
T2		1	2.445275 GHz	-4.06 dBm		
M2		1	**2.424075 GHz**	**-22.14 dBm**		
D3	M2	1	**24.7 MHz**	**-0.20 dB**		

- High Channel:

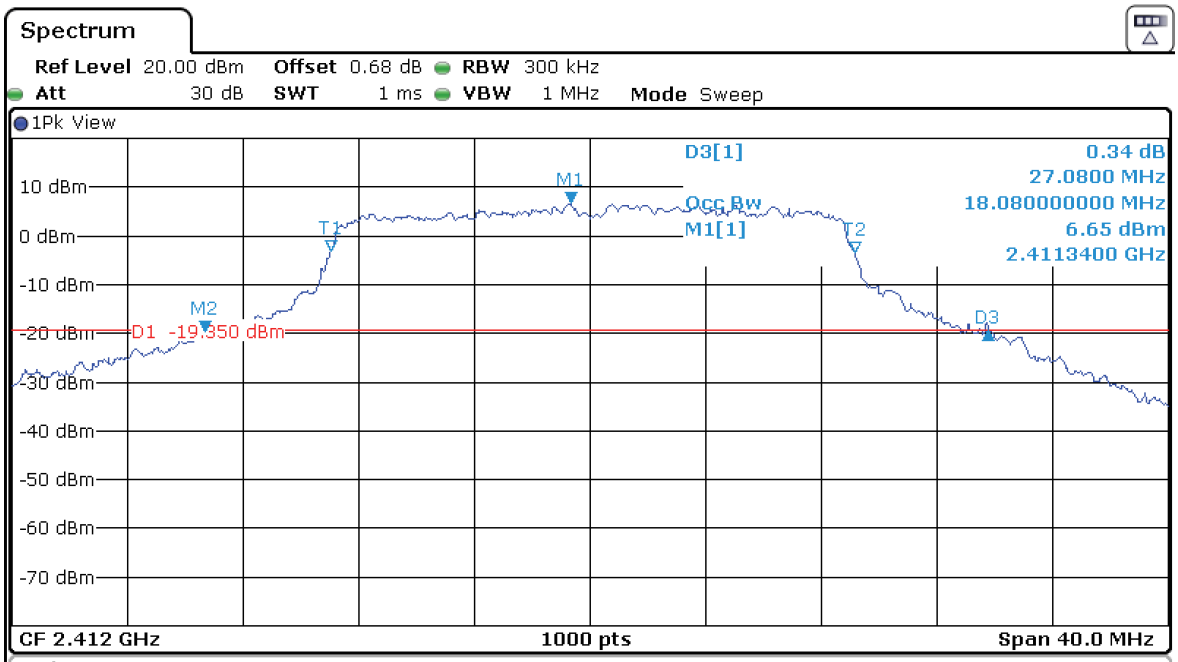


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.458875 GHz**	**5.23 dBm**		
T1		1	2.453675 GHz	-3.91 dBm	Occ Bw	**16.5 MHz**
T2		1	2.470175 GHz	-2.37 dBm		
M2		1	**2.450325 GHz**	**-21.72 dBm**		
D3	M2	1	**22.45 MHz**	**0.73 dB**		

- **Mode 802.11 n20 – Occupied Bandwidth**

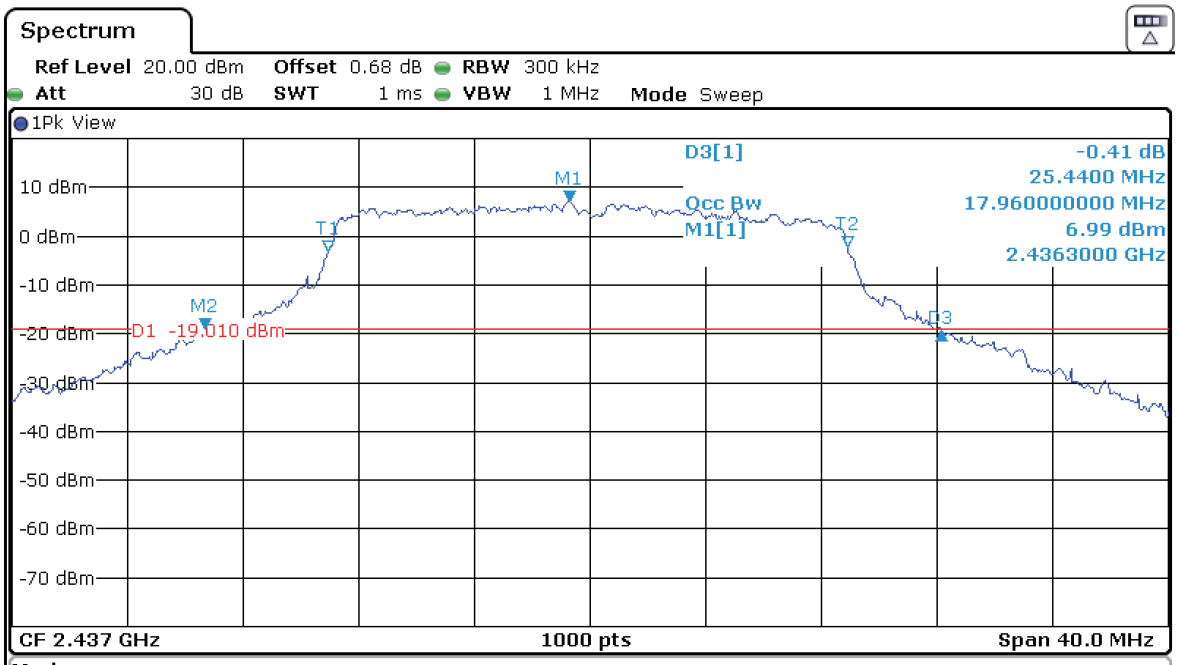
- Low Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41134 GHz	6.65 dBm		
T1		1	2.40306 GHz	-3.22 dBm	Occ Bw	18.08 MHz
T2		1	2.42114 GHz	-3.37 dBm		
M2		1	2.3987 GHz	-19.68 dBm		
D3	M2	1	27.08 MHz	0.34 dB		

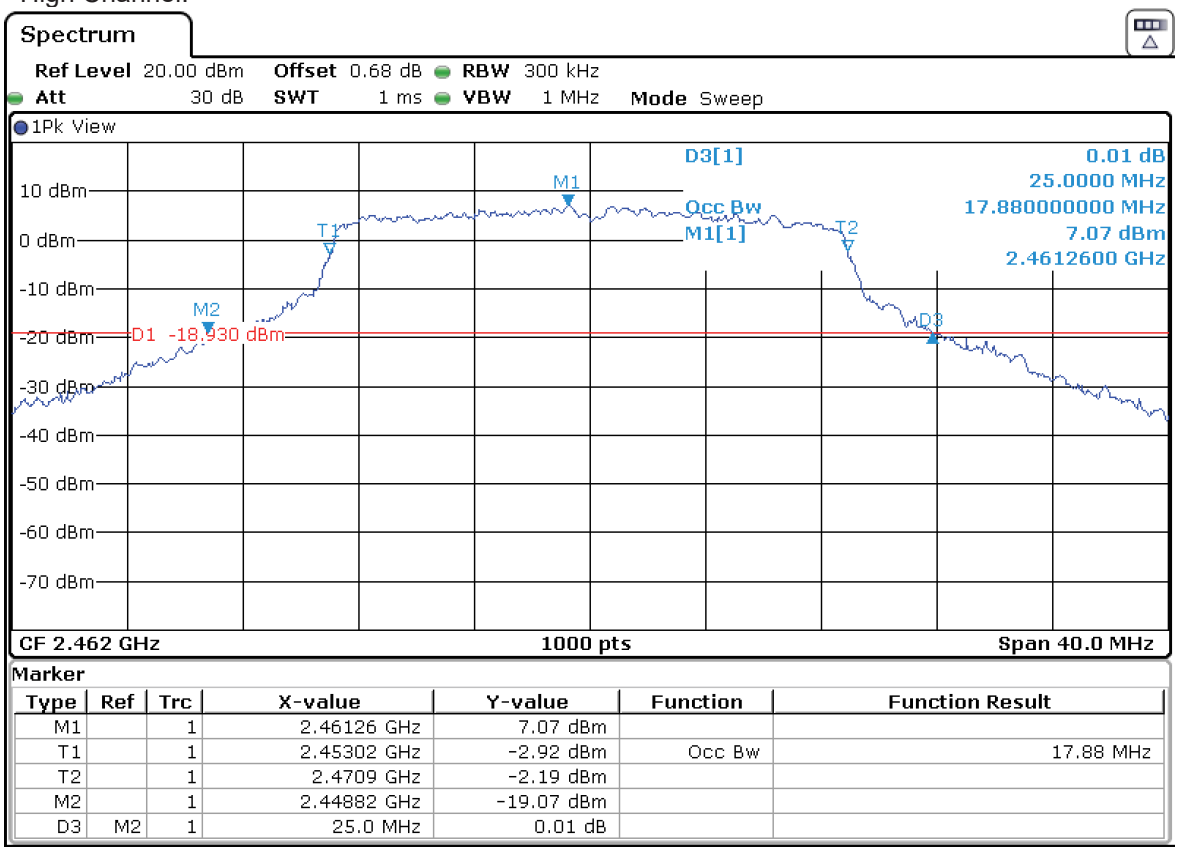
- Middle Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4363 GHz	6.99 dBm		
T1		1	2.42794 GHz	-3.03 dBm	Occ Bw	17.96 MHz
T2		1	2.4459 GHz	-2.36 dBm		
M2		1	2.4237 GHz	-19.05 dBm		
D3	M2	1	25.44 MHz	-0.41 dB		

- High Channel:

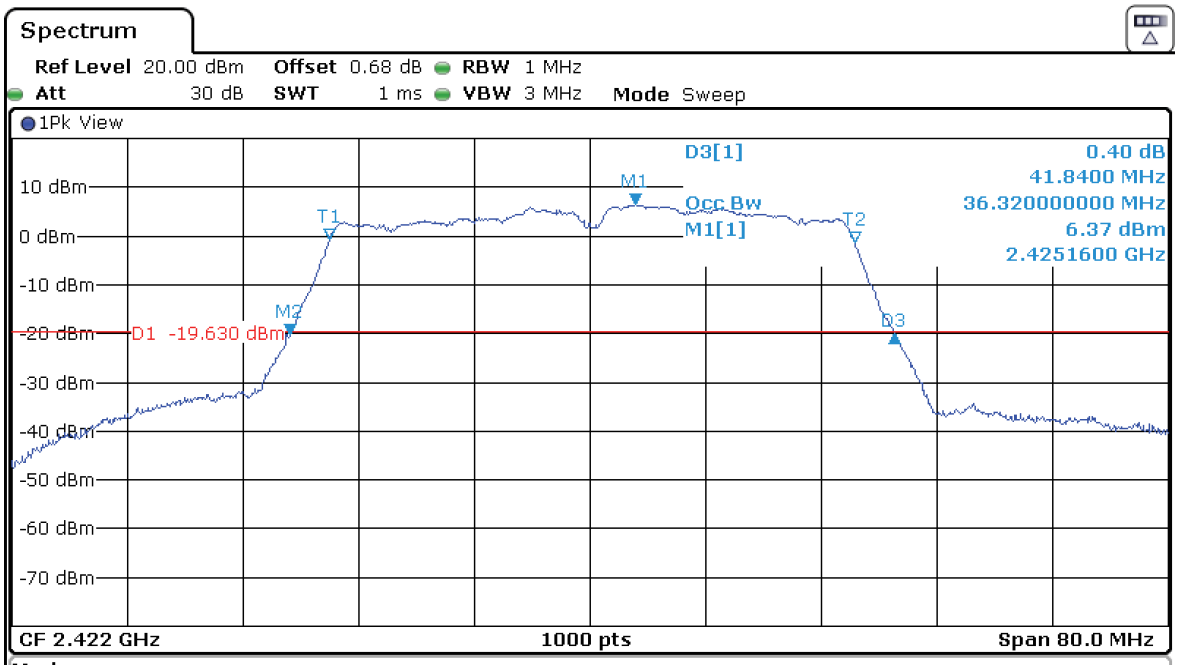


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46126 GHz	7.07 dBm		
T1		1	2.45302 GHz	-2.92 dBm	Occ Bw	17.88 MHz
T2		1	2.4709 GHz	-2.19 dBm		
M2		1	2.44882 GHz	-19.07 dBm		
D3	M2	1	25.0 MHz	0.01 dB		

- **Mode 802.11 n40 – Occupied Bandwidth**

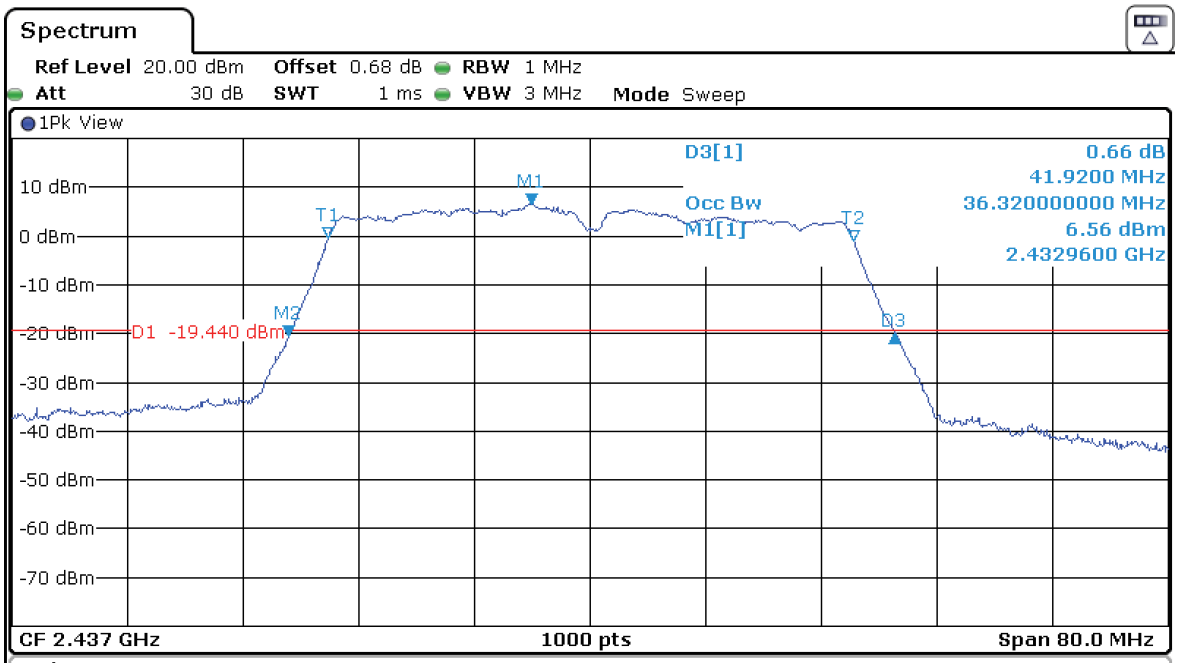
- Low Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.42516 GHz	6.37 dBm		
T1		1	2.40396 GHz	-0.86 dBm	Occ Bw	36.32 MHz
T2		1	2.44028 GHz	-1.22 dBm		
M2		1	2.40124 GHz	-20.23 dBm		
D3	M2	1	41.84 MHz	0.40 dB		

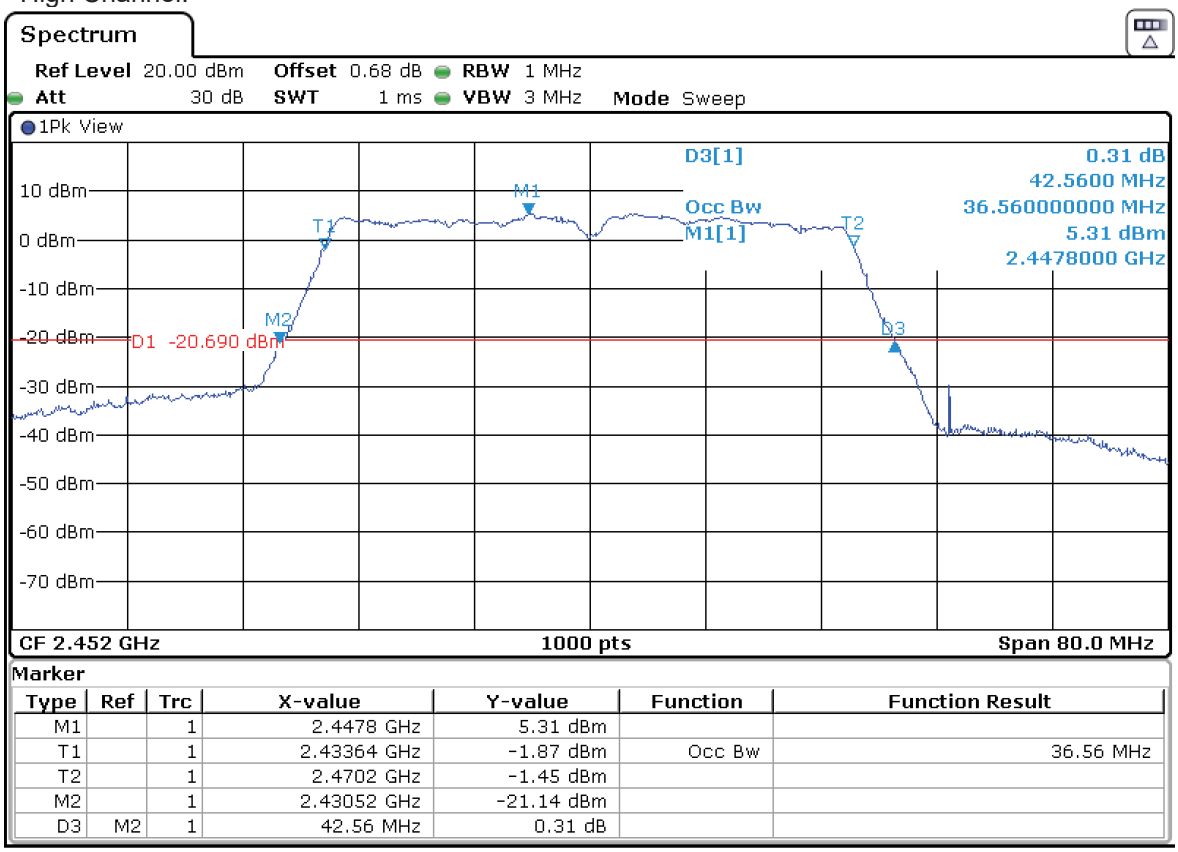
- Middle Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.43296 GHz	6.56 dBm		
T1		1	2.41888 GHz	-0.44 dBm	Occ Bw	36.32 MHz
T2		1	2.4552 GHz	-1.05 dBm		
M2		1	2.41612 GHz	-20.57 dBm		
D3	M2	1	41.92 MHz	0.66 dB		

- High Channel:



Marker

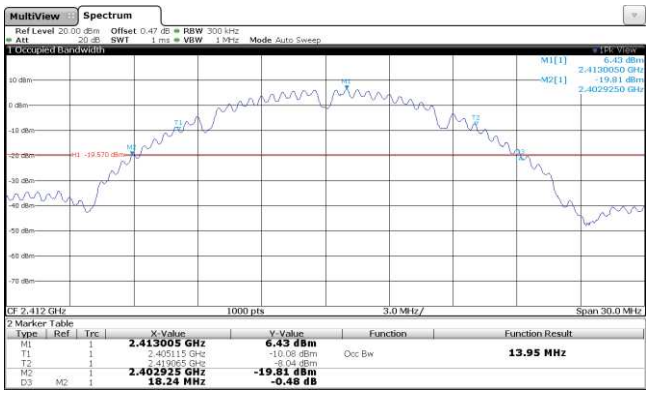
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4478 GHz	5.31 dBm		
T1		1	2.43364 GHz	-1.87 dBm	Occ Bw	36.56 MHz
T2		1	2.4702 GHz	-1.45 dBm		
M2		1	2.43052 GHz	-21.14 dBm		
D3	M2	1	42.56 MHz	0.31 dB		

MIMO – CHAIN0 Antenna & CHAIN1 Antenna:

- **Mode 802.11 b – Occupied Bandwidth**

- Low Channel:

CHAIN0

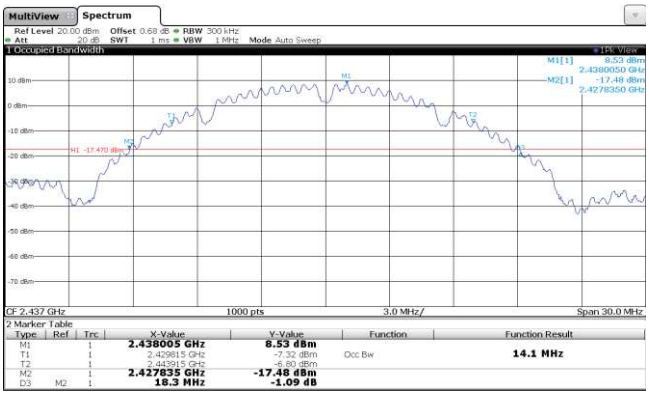


CHAIN1

- Middle Channel:

CHAIN0

CHAIN1



- High Channel:

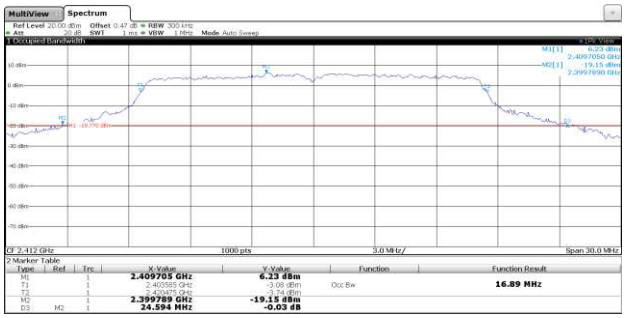
CHAIN0

CHAIN1

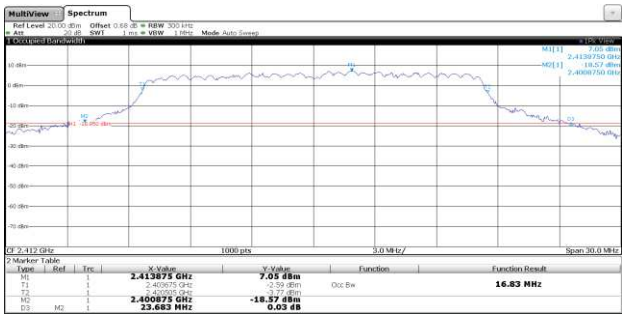
- **Mode 802.11 g – Occupied Bandwidth**

- Low Channel:

CHAIN0

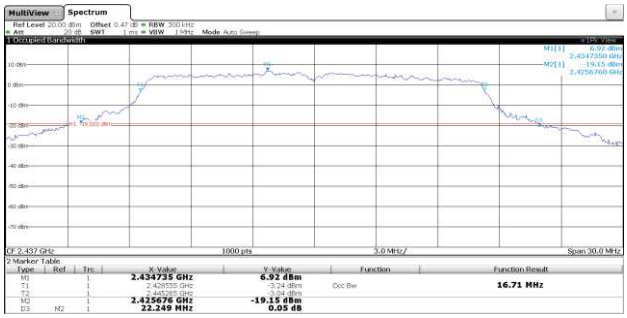


CHAIN1

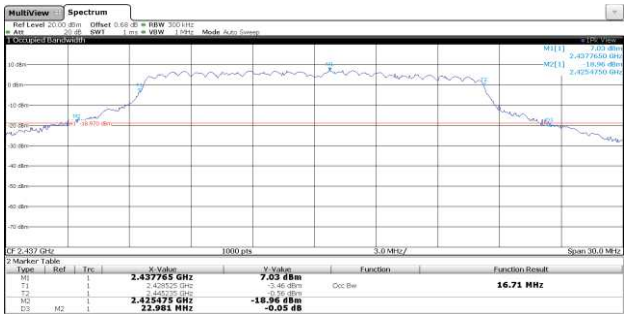


- Middle Channel:

CHAIN0

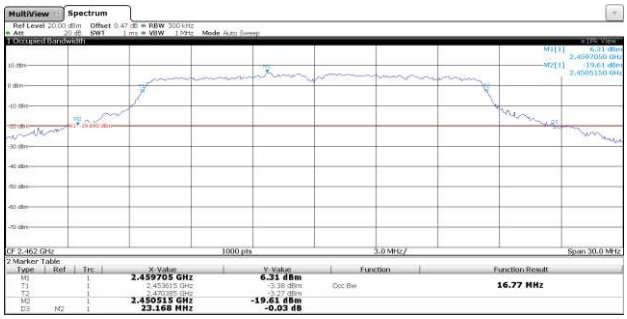


CHAIN1

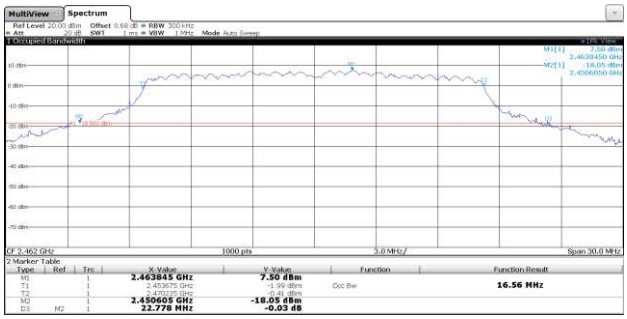


- High Channel:

CHAIN0



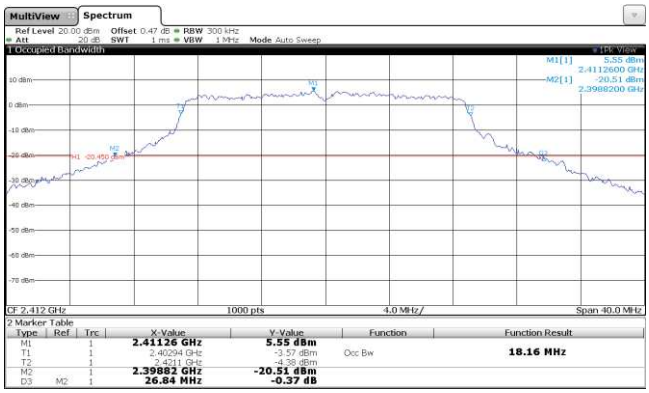
CHAIN1



- **Mode 802.11 n20 – Occupied Bandwidth**

- Low Channel:

CHAIN0



CHAIN1

- Middle Channel:

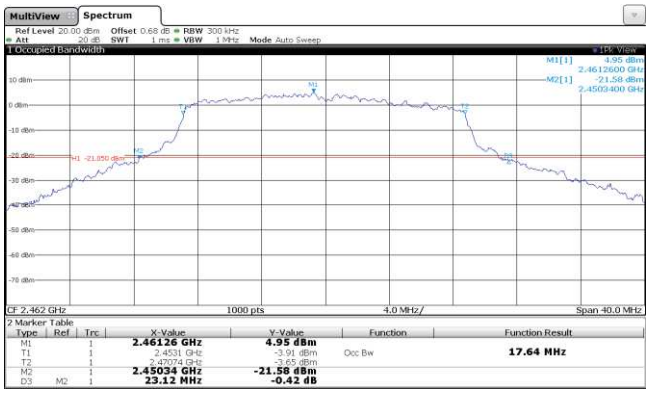
CHAIN0

CHAIN1

- High Channel:

CHAIN0

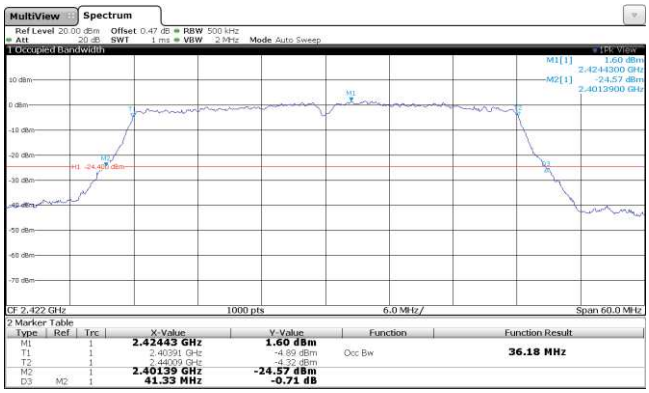
CHAIN1



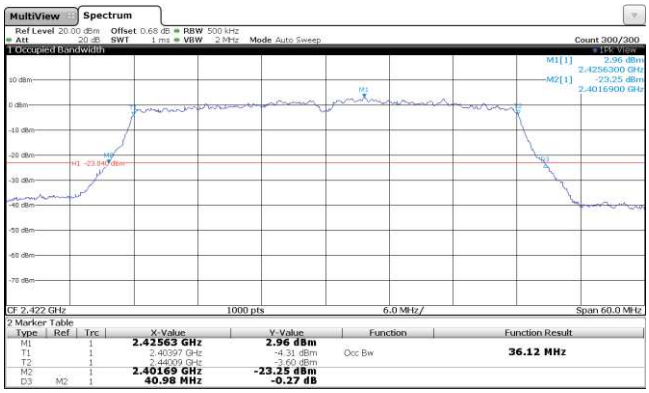
- **Mode 802.11 n40 – Occupied Bandwidth**

- Low Channel:

CHAIN0



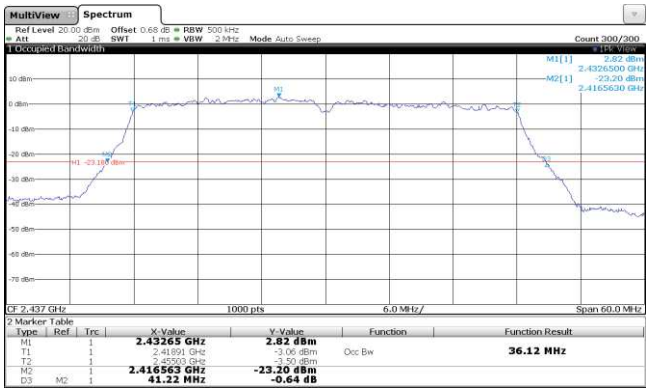
CHAIN1



- Middle Channel:

CHAIN0

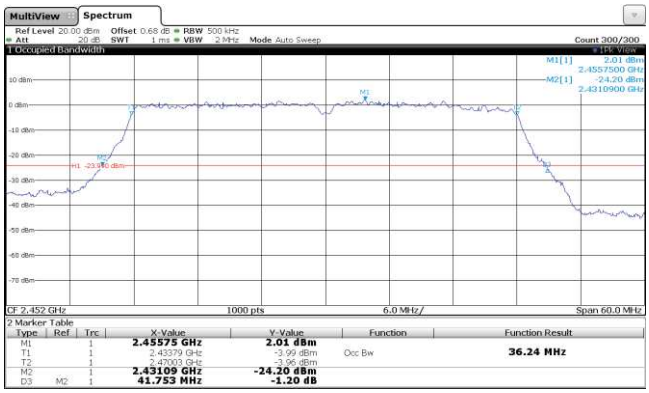
CHAIN1



- High Channel:

CHAIN0

CHAIN1



FCC Section 15.247 Subclause (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth.

SPECIFICATION:

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

CHAIN1 – Antenna:

- **Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
6 dB Spectrum bandwidth (MHz)	9.1	9.08	9.08
Measurement uncertainty (kHz)	<±11.01		

- **Mode 802.11 g**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
6 dB Spectrum bandwidth (MHz)	15.78	15.75	15.15
Measurement uncertainty (kHz)	<±16.02		

- **Mode 802.11 n20**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
6 dB Spectrum bandwidth (MHz)	17.2	16.35	15.5
Measurement uncertainty (kHz)	<±13.51		

- **Mode 802.11 n40**

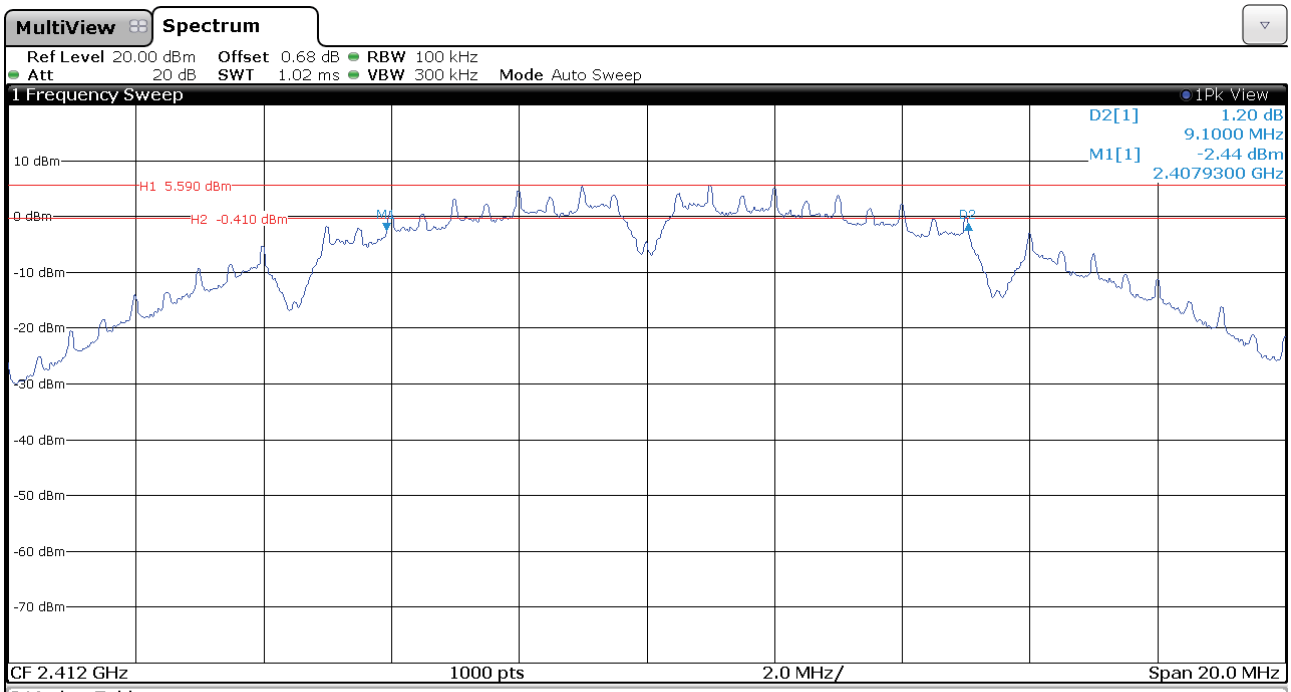
	Low Channel 2422 MHz	Middle Channel 2437 MHz	High Channel 2452 MHz
6 dB Spectrum bandwidth (MHz)	35.145	35.13	35.82
Measurement uncertainty (kHz)	<±23.52		

Verdict: PASS

CHAIN 1 – Antenna:

- **Mode 802.11 b – 6 dB Bandwidth**

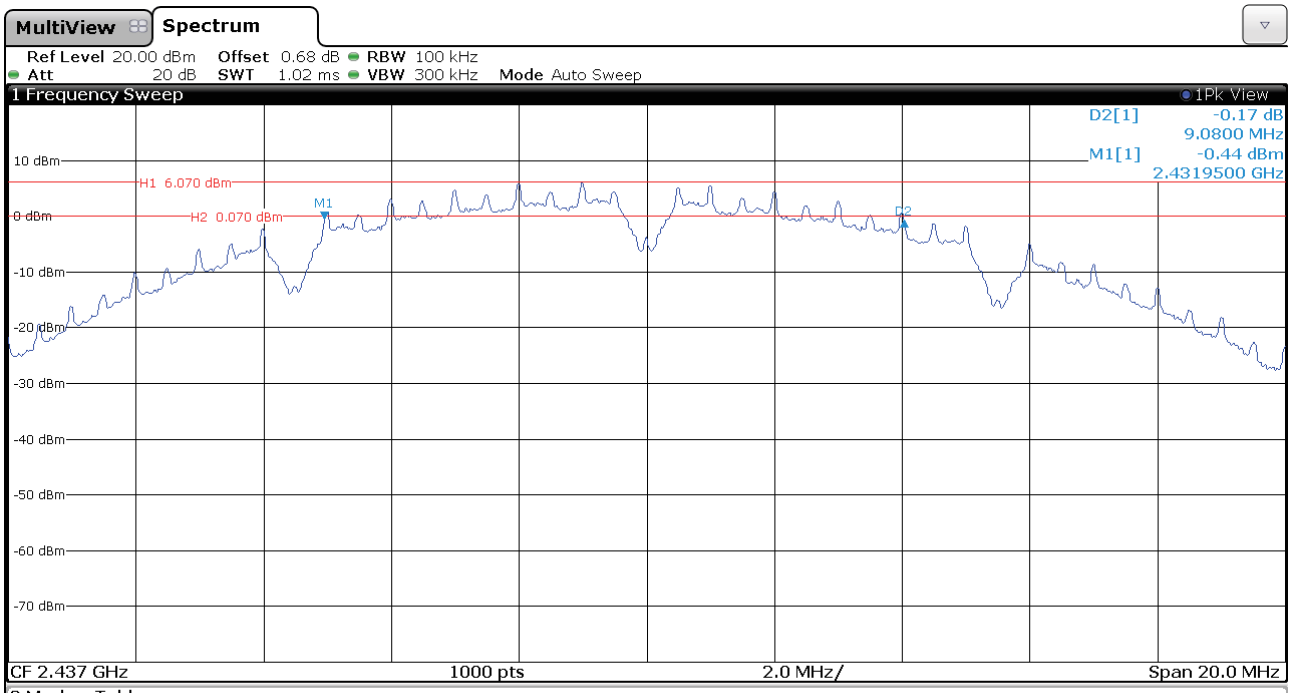
- Low Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.40793 GHz**	**-2.44 dBm**		
D2	M1	1	**9.1 MHz**	**1.20 dB**		

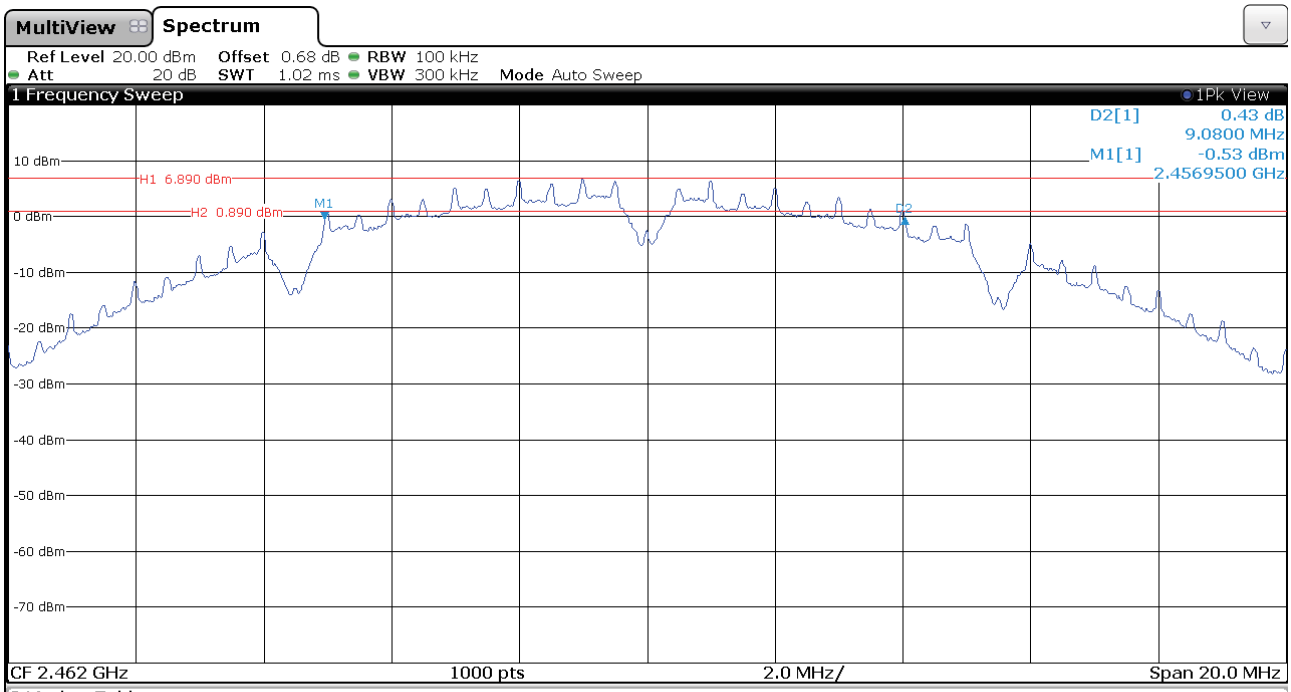
- Middle Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.43195 GHz**	**-0.44 dBm**		
D2	M1	1	**9.08 MHz**	**-0.17 dB**		

- High Channel:

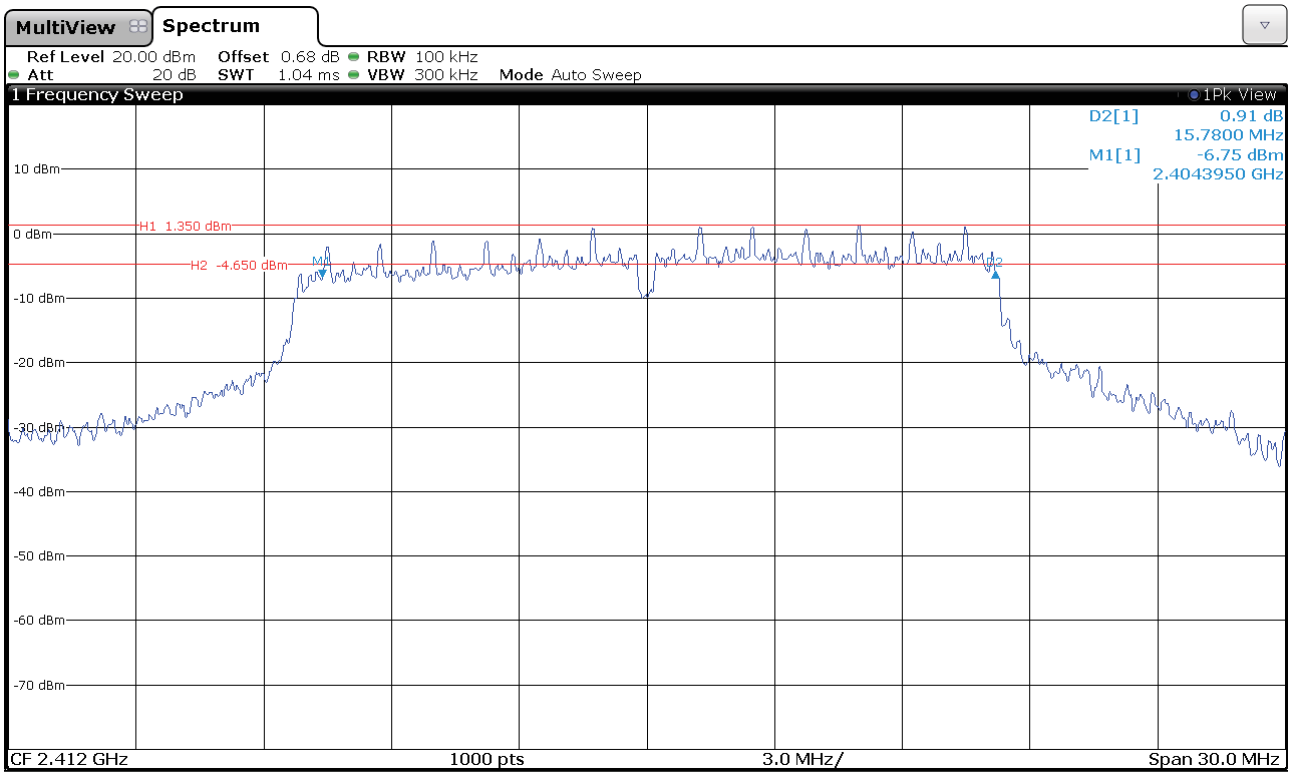


2 Marker Table

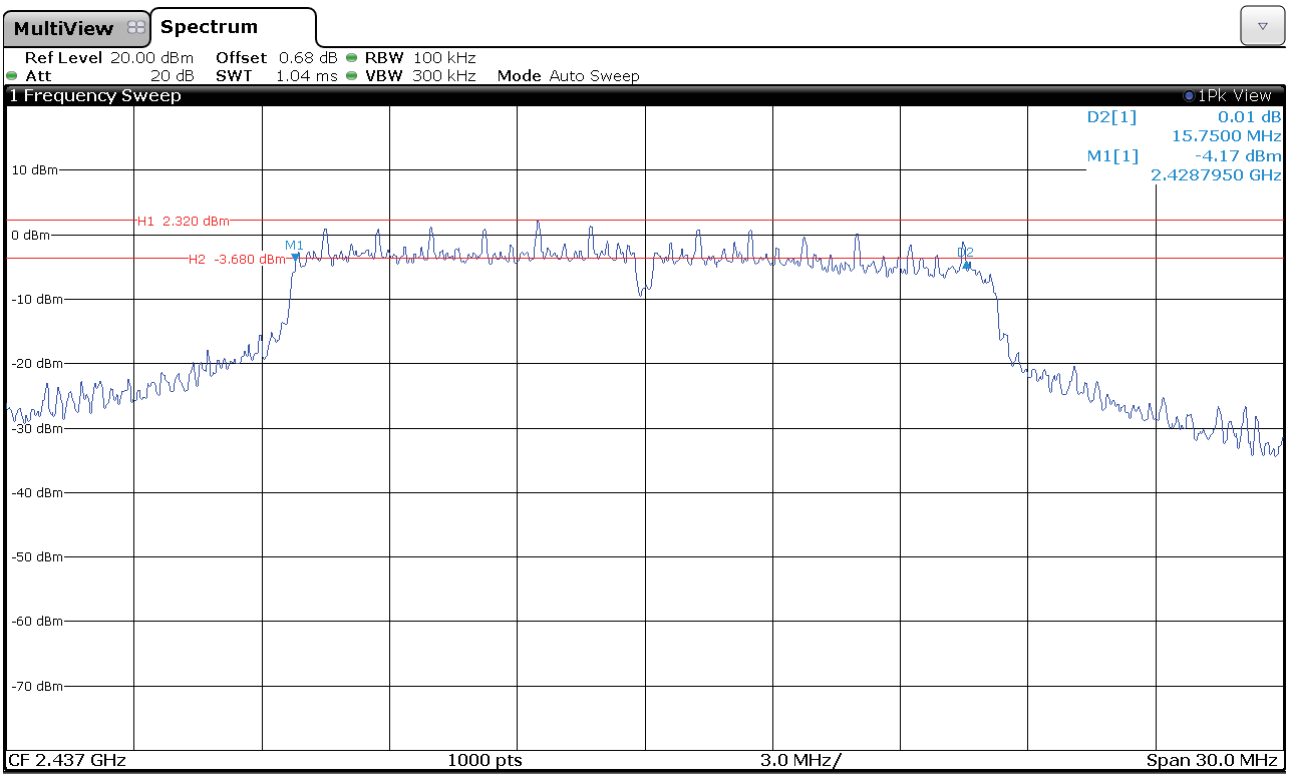
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.45695 GHz**	**-0.53 dBm**		
D2	M1	1	**9.08 MHz**	**0.43 dB**		

- **Mode 802.11 g – 6 dB Bandwidth**

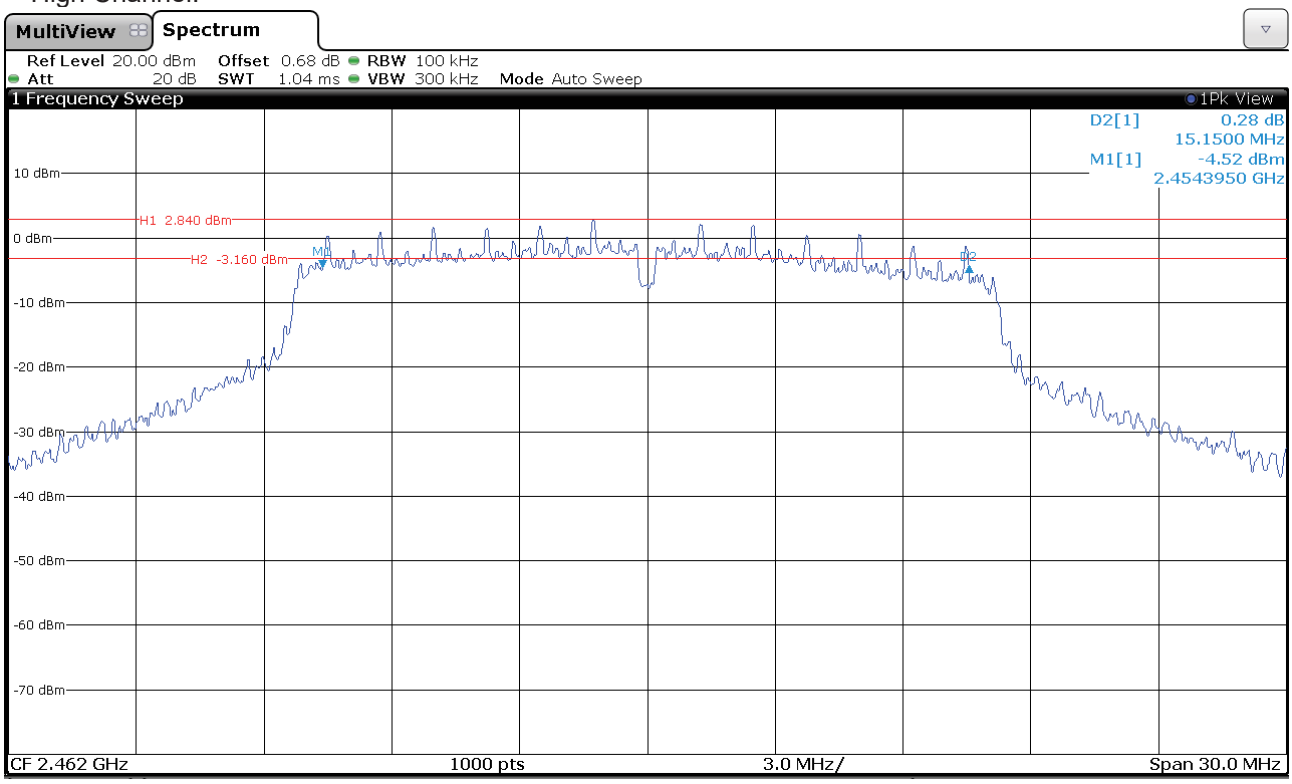
- Low Channel:



- Middle Channel:

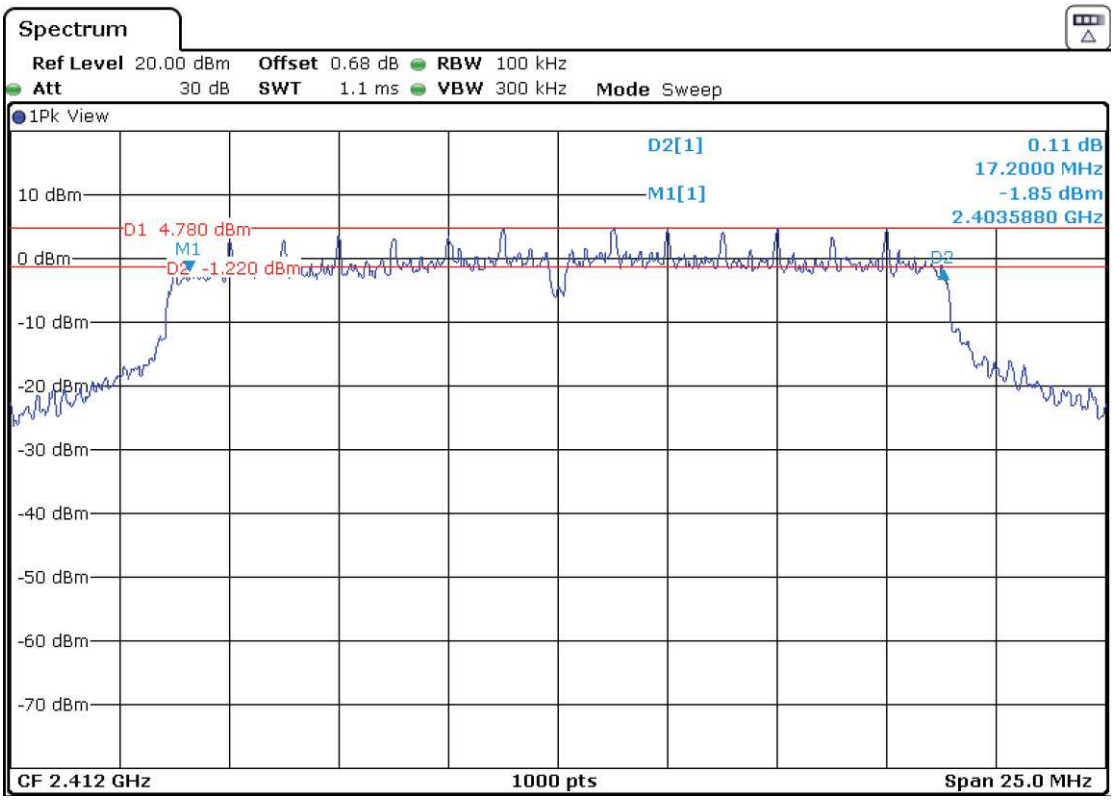


- High Channel:

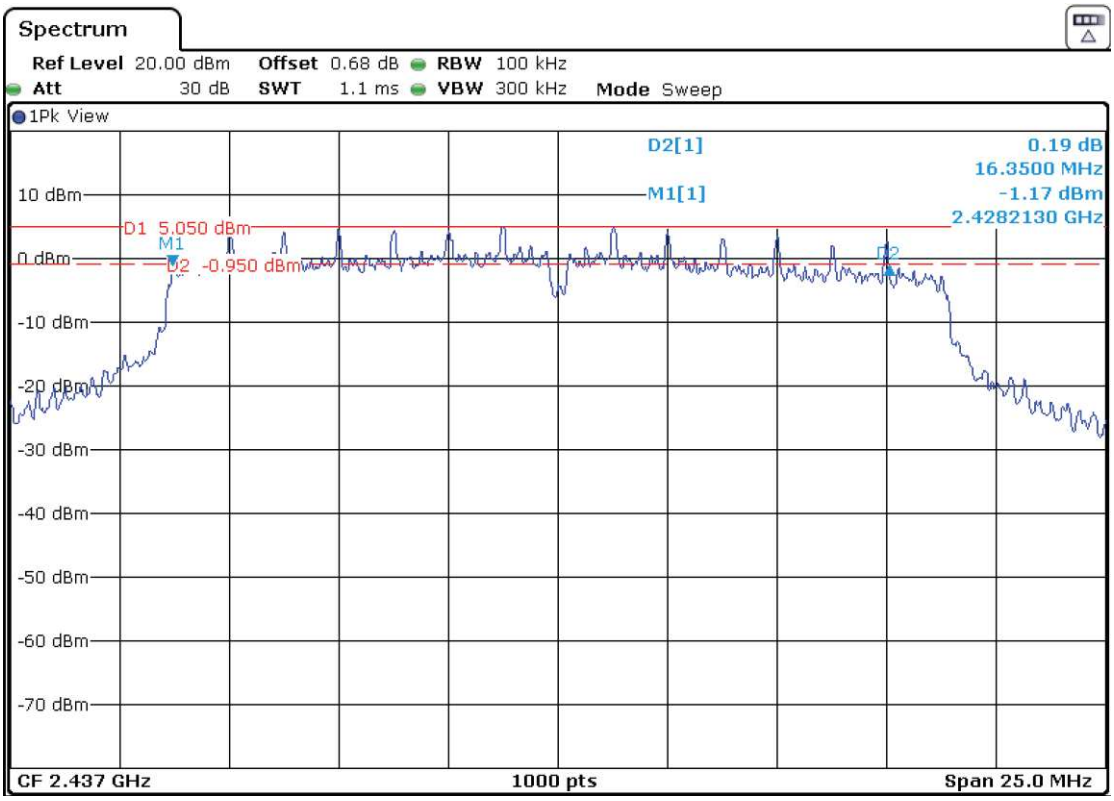


- **Mode 802.11 n20 – 6 dB Bandwidth**

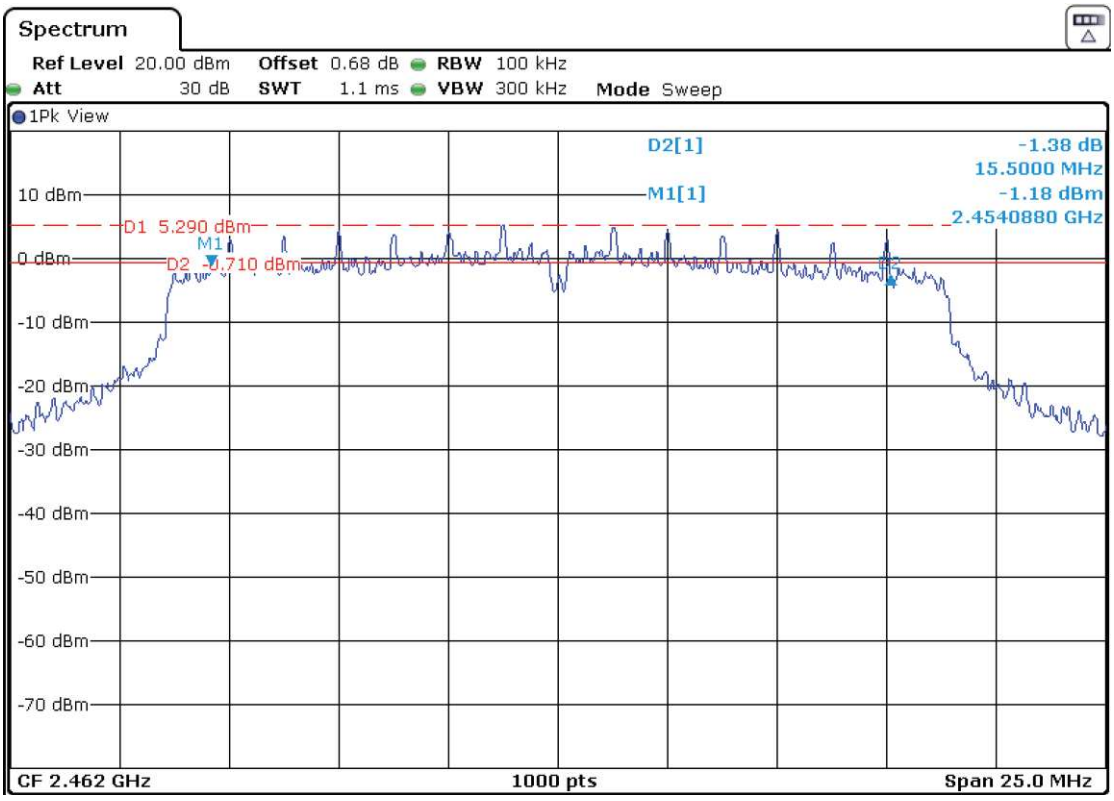
- Low Channel:



- Middle Channel:

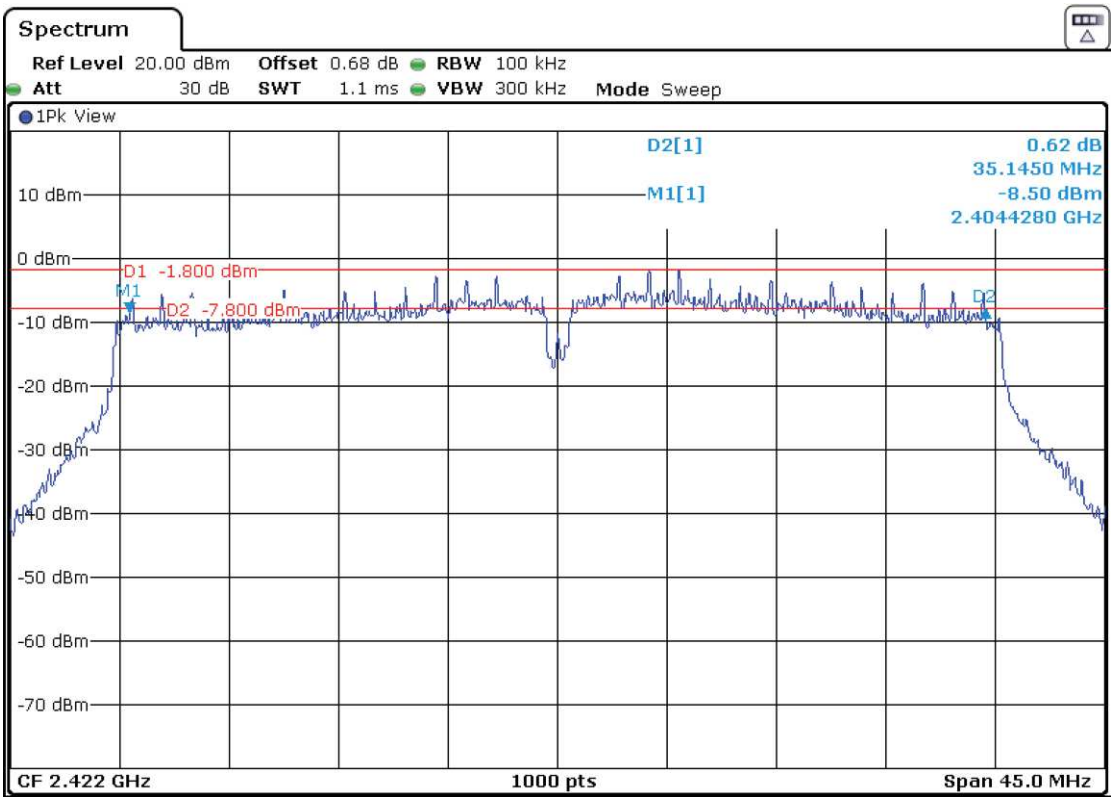


- High Channel:

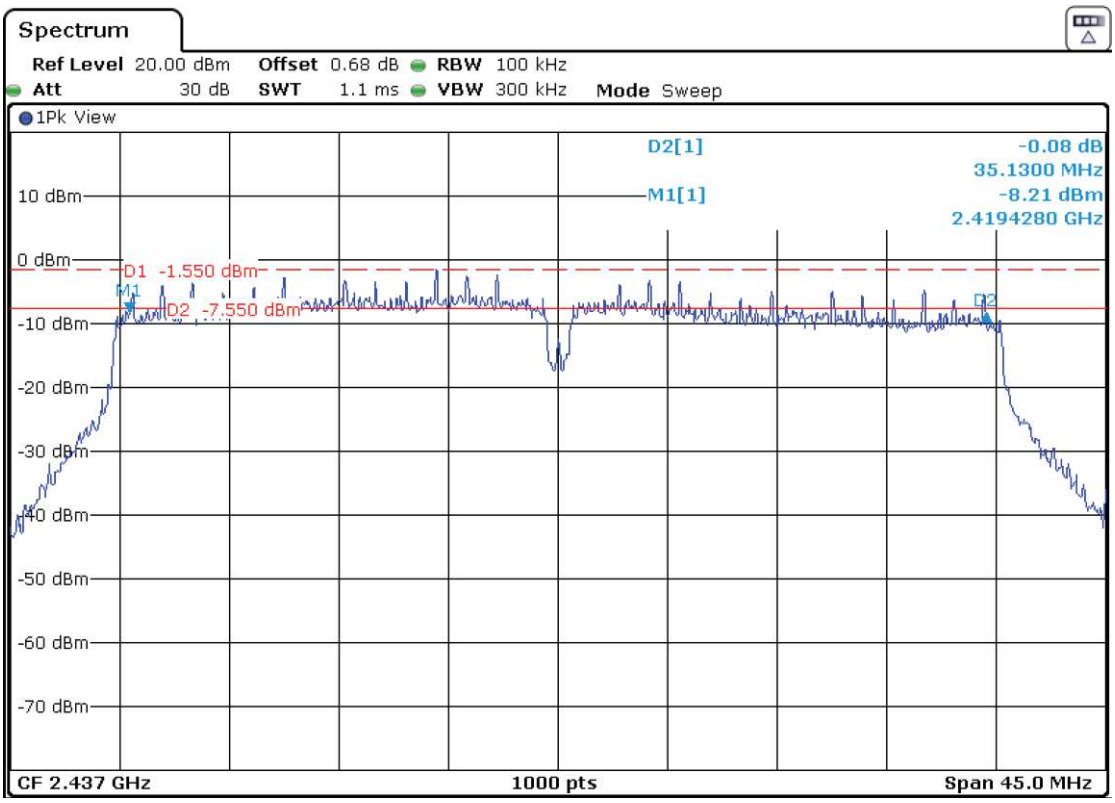


- **Mode 802.11 n40 – 6 dB Bandwidth**

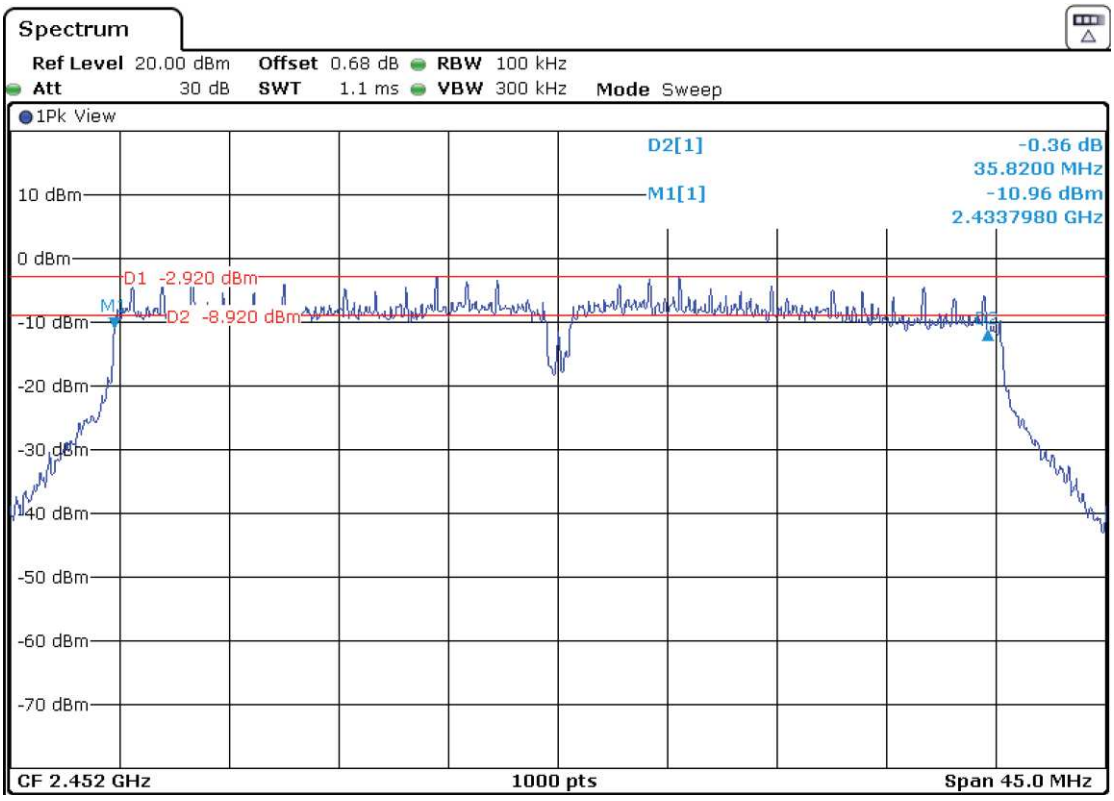
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.35 Subclause (c) / RSS-Gen 6.10. Transmitter Duty Cycle.

SPECIFICATION

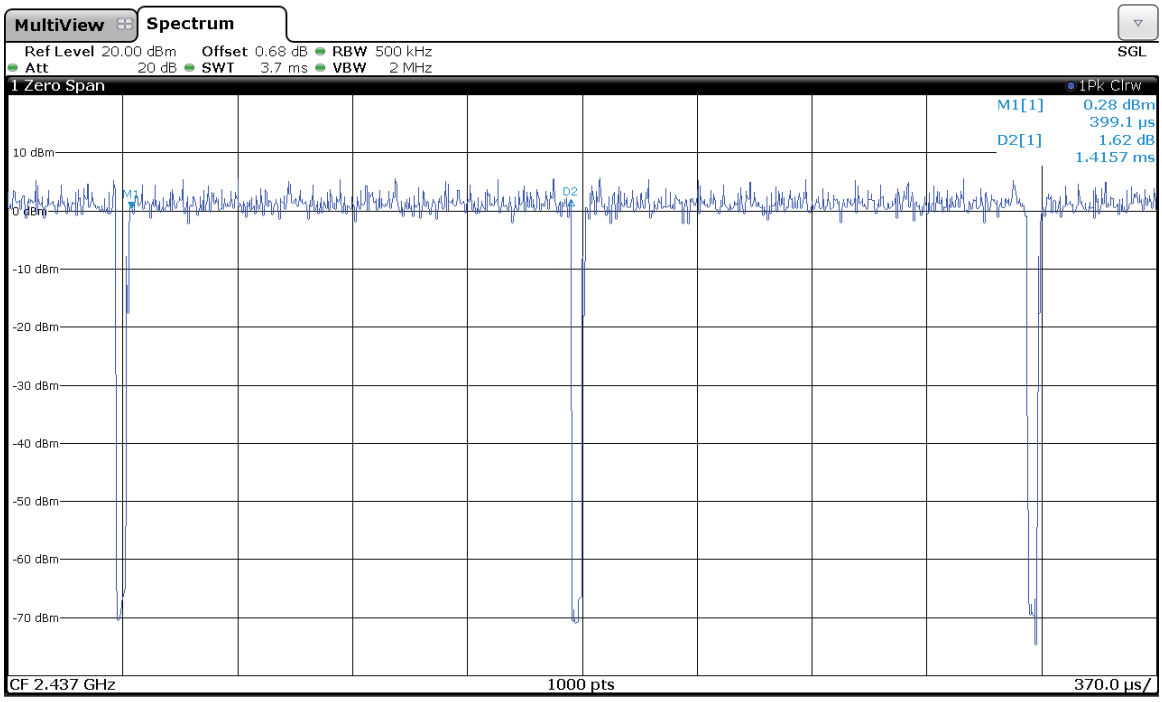
When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

RESULTS:

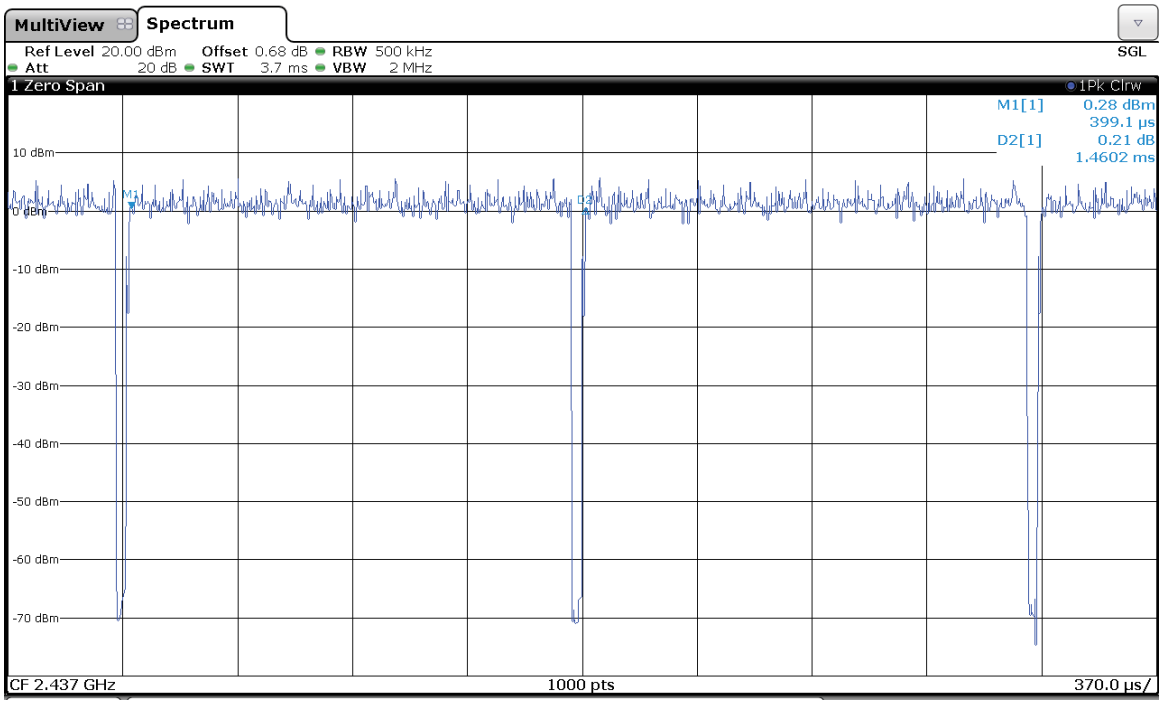
The results below are for data rates with a duty cycle less than 98%. The results for all rest of modes having a value > 98%.

Mode	Pulse Duration (ms)	Period (ms)	Duty Cycle correction (dB)
802.11 / 20 MHz / MIMO	1.4157	1.4602	0.134
802.11 / 40 MHz / MIMO	1.3268	1.3787	0.167
802.11 / 80 MHz / MIMO	0.6642	0.7142	0.315

802.11 / 20 MHz / MIMO
Pulse Duration:

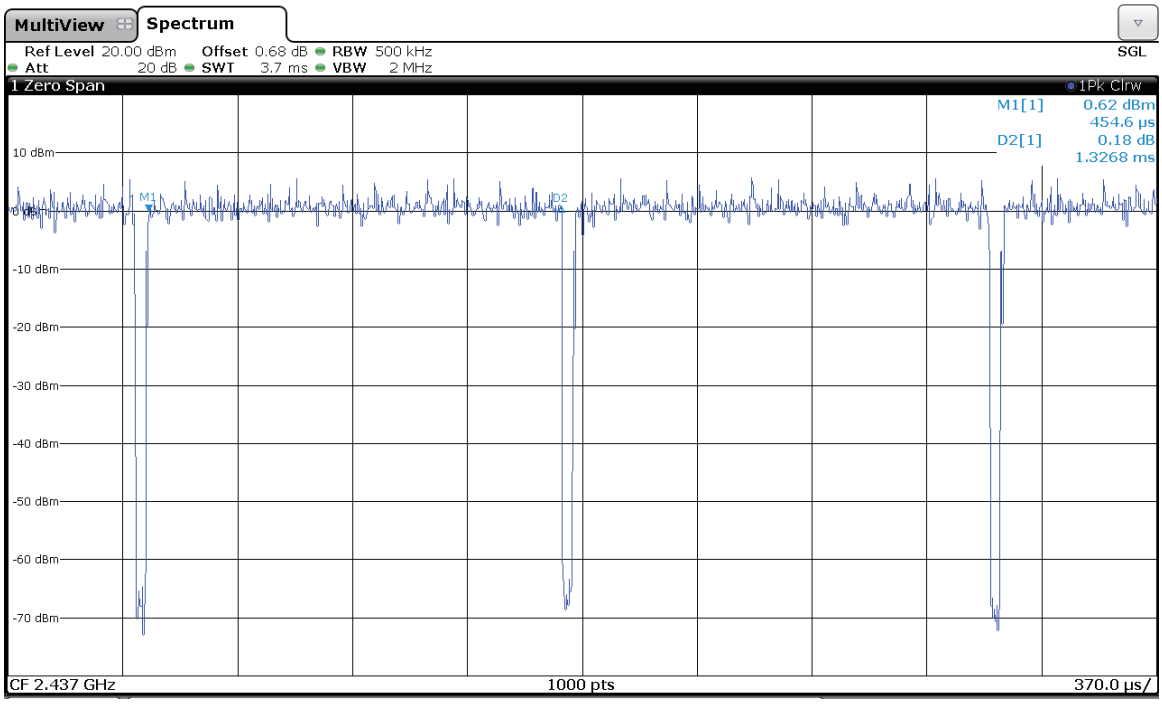


Period:

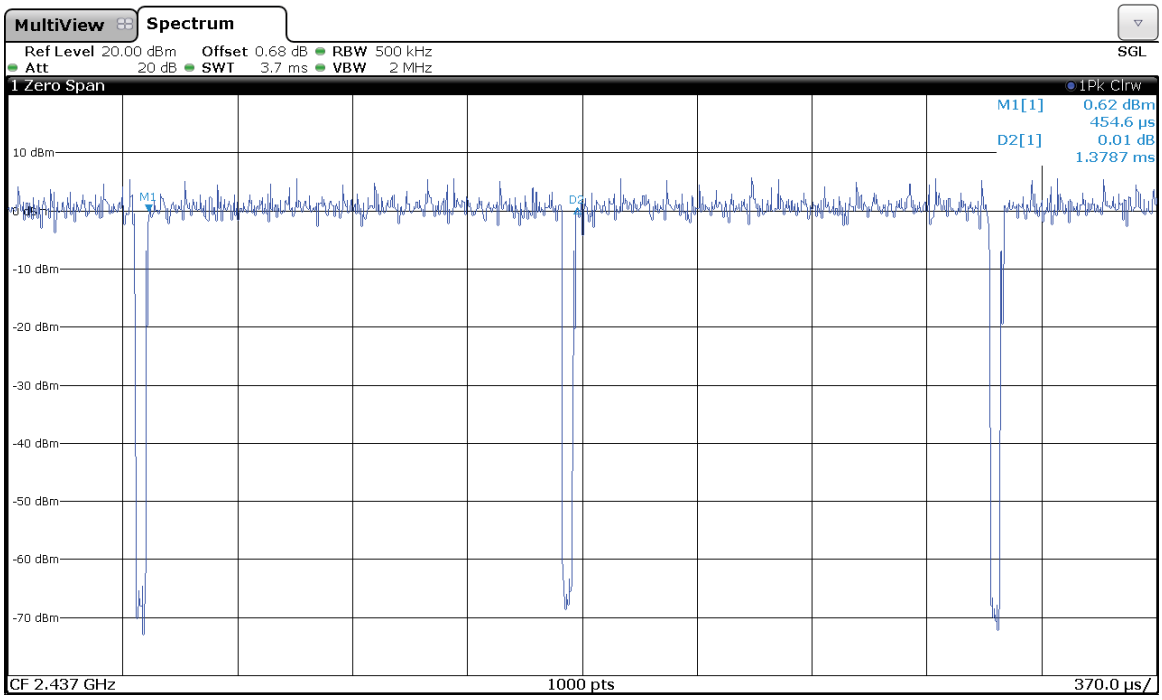


802.11 / 40 MHz / MIMO

Pulse Duration:

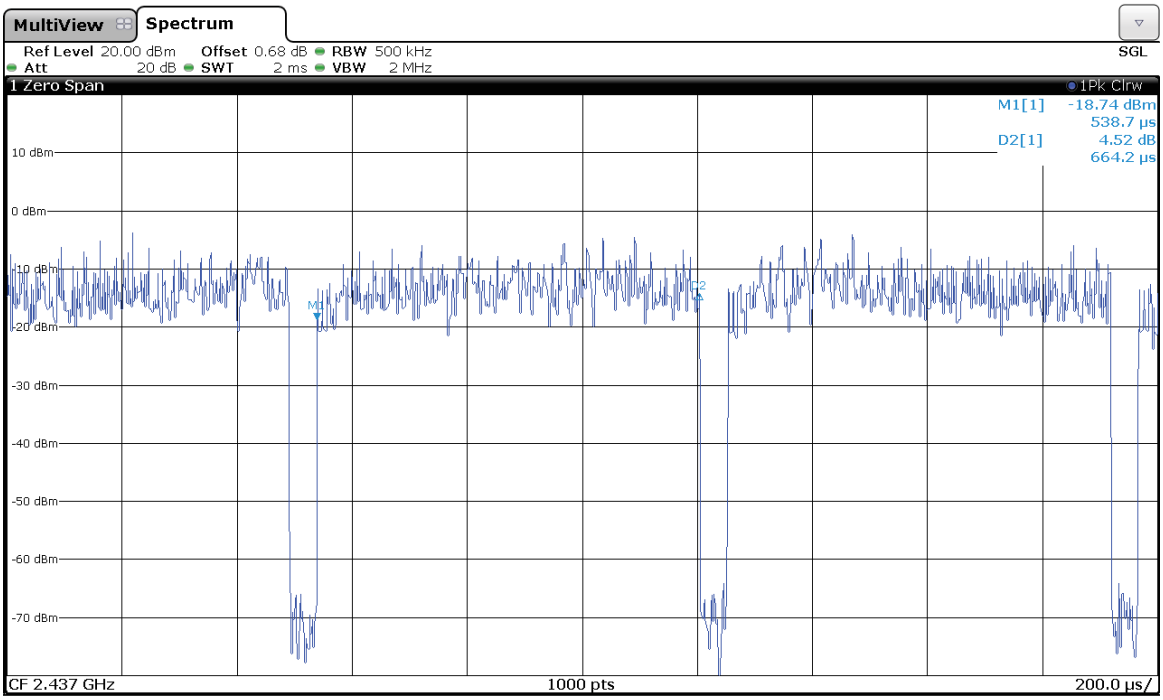


Period:

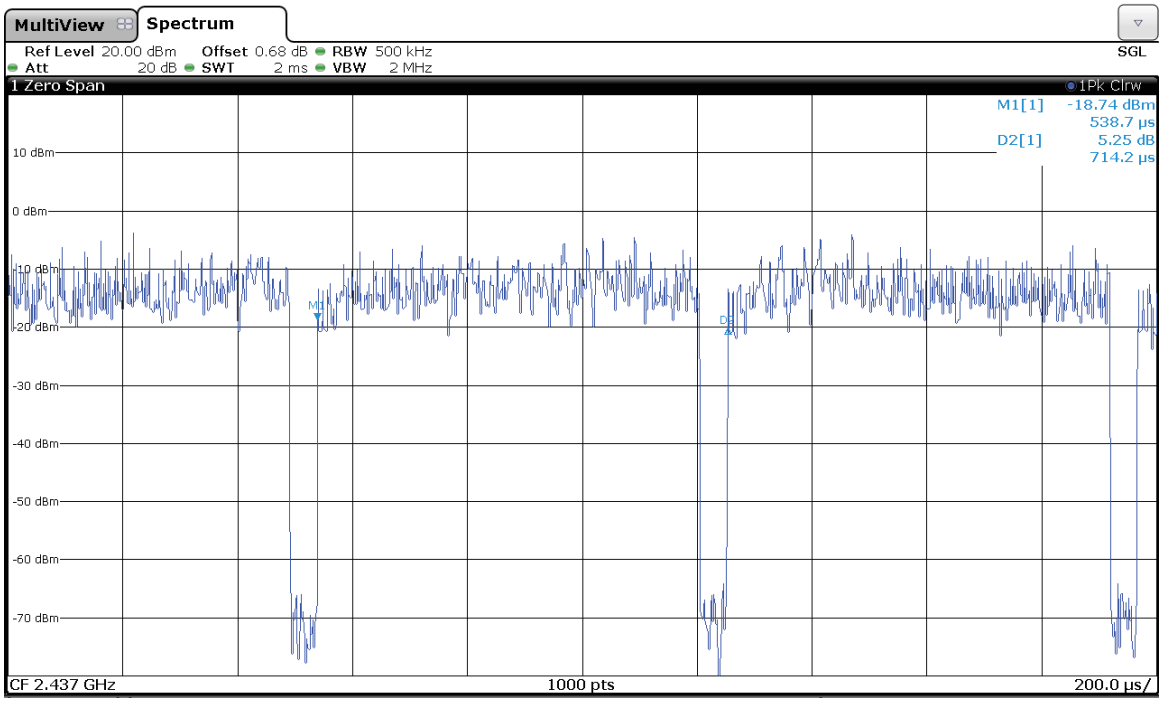


802.11 / 80 MHz / MIMO

Pulse Duration:



Period:



FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (d) Maximum output power and antenna gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

For b and n40 modes, the maximum conducted output power was measured using the method according to point 11.9.2.2.1 “Method AVGSA-1” of ANSI C.63.10-2013.

For g and n20 modes, the maximum conducted output power was measured using the method according to point 11.9.1.3 “Method PKPM1” of ANSI C.63.10-2013.

For MIMO modes, the power spectral density was measured using the method according to point 11.9.2.2.4 “Method AVGSA-1” of ANSI C.63.10-2013.

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

- CHAIN1 – Maximum Declared Antenna Gain: +2.2 dBi

CHAIN1 – Antenna: (worst case)

- **Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Average Conducted Power (dBm)	13.91	14.25	14.91
Maximum EIRP Power (dBm)	16.11	16.45	17.11
Measurement uncertainty (dB)	<±0.79		

- **Mode 802.11 g**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Peak Conducted Power (dBm)	19.93	19.99	20.05
Maximum EIRP Power (dBm)	22.13	22.19	22.25
Measurement uncertainty (dB)	<±0.79		

- **Mode 802.11 n20**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Peak Conducted Power (dBm)	18.56	18.61	18.97
Maximum EIRP Power (dBm)	20.76	20.81	21.17
Measurement uncertainty (dB)	<±0.79		

- **Mode 802.11 n40**

	Low Channel 2422 MHz	Middle Channel 2437 MHz	High Channel 2452 MHz
Maximum Average Conducted Power (dBm)	10.78	10.85	10.52
Maximum EIRP Power (dBm)	12.98	13.05	12.72
Measurement uncertainty (dB)	<±0.79		

Verdict: PASS
* CHAIN0+CHAIN1 – Maximum Declared Antenna Gain: +2.99 dBi

MIMO – CHAIN0 Antenna & CHAIN1 Antenna:

- **Mode 802.11 b**

	Low Channel 2412 MHz		Middle Channel 2437 MHz		High Channel 2462 MHz	
	CHAIN0	CHAIN1	CHAIN0	CHAIN1	CHAIN0	CHAIN1
Maximum Average Conducted Power (dBm)	13.9	14.66	14.27	14.79	13.94	14.89
	CHAIN0 + CHAIN1		CHAIN0 + CHAIN1		CHAIN0 + CHAIN1	
Maximum Average Conducted Power (dBm)	17.31		17.55		17.45	
Maximum EIRP Power (dBm)	20.30		20.54		20.44	
Measurement uncertainty (dB)	<±1.20					

- **Mode 802.11 g**

	Low Channel 2412 MHz		Middle Channel 2437 MHz		High Channel 2462 MHz	
	CHAIN0	CHAIN1	CHAIN0	CHAIN1	CHAIN0	CHAIN1
Maximum Average Conducted Power (dBm)	10.73	11.31	11.19	11.16	11.05	11.44
Duty Cycle Correction Factor (dB)	0.134		0.134		0.134	
Maximum Average Conducted Power corrected (dBm)	10.86	11.44	11.32	11.29	11.18	11.57
	CHAIN0 + CHAIN1		CHAIN0 + CHAIN1		CHAIN0 + CHAIN1	
Maximum Conducted Power (dBm)	14.17		14.32		14.39	
Maximum EIRP Power (dBm)	17.17		17.31		17.39	
Measurement uncertainty (dB)	<±1.20					

- **Mode 802.11 n20**

	Low Channel 2412 MHz		Middle Channel 2437 MHz		High Channel 2462 MHz	
	CHAIN0	CHAIN1	CHAIN0	CHAIN1	CHAIN0	CHAIN1
Maximum Average Conducted Power (dBm)	13.37	13.83	13.55	13.82	13.4	13.89
Duty Cycle Correction Factor (dB)	0.167		0.167		0.167	
Maximum Average Conducted Power corrected (dBm)	13.54	14	13.72	13.99	13.57	14.06
	CHAIN0 + CHAIN1		CHAIN0 + CHAIN1		CHAIN0 + CHAIN1	
Maximum Conducted Power (dBm)	16.78		16.86		16.83	
Maximum EIRP Power (dBm)	19.78		19.86		19.82	
Measurement uncertainty (dB)	<±1.20					