

Appendix B: Test results. 802.11 bgn20 1x1.

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal: 12 Vdc

Type of Power Supply: External power supply (Battery).

Type of Antenna: External.

Declared Gain for antenna RF port 1(maximum): +2.2 dBi (Antenna gain plus antenna cable loss).

TEST FREQUENCIES:

Low Channel: 2412 MHz

Middle Channel: 2437 MHz

High Channel: 2462 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

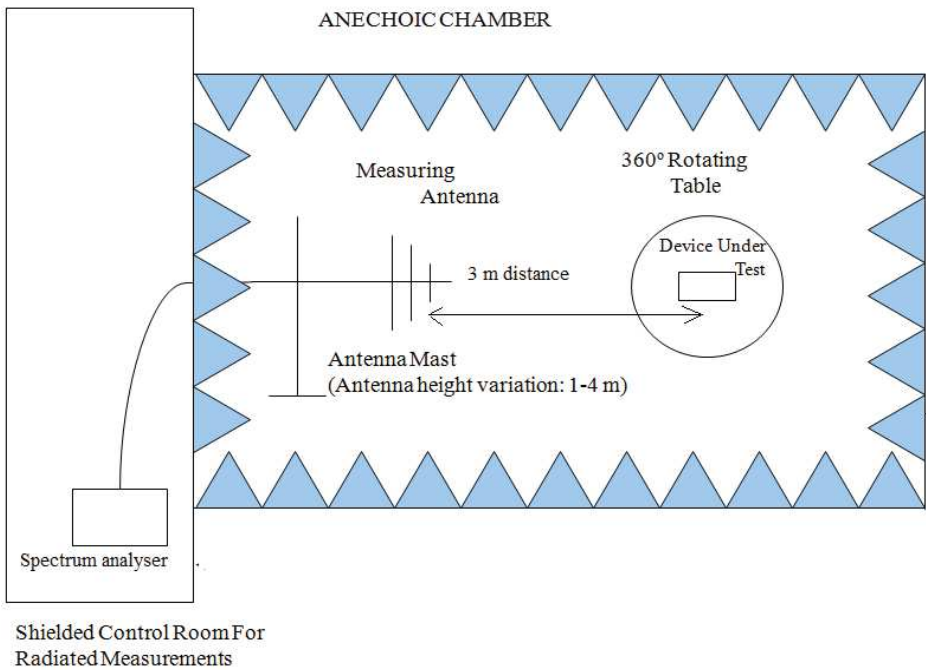
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

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.

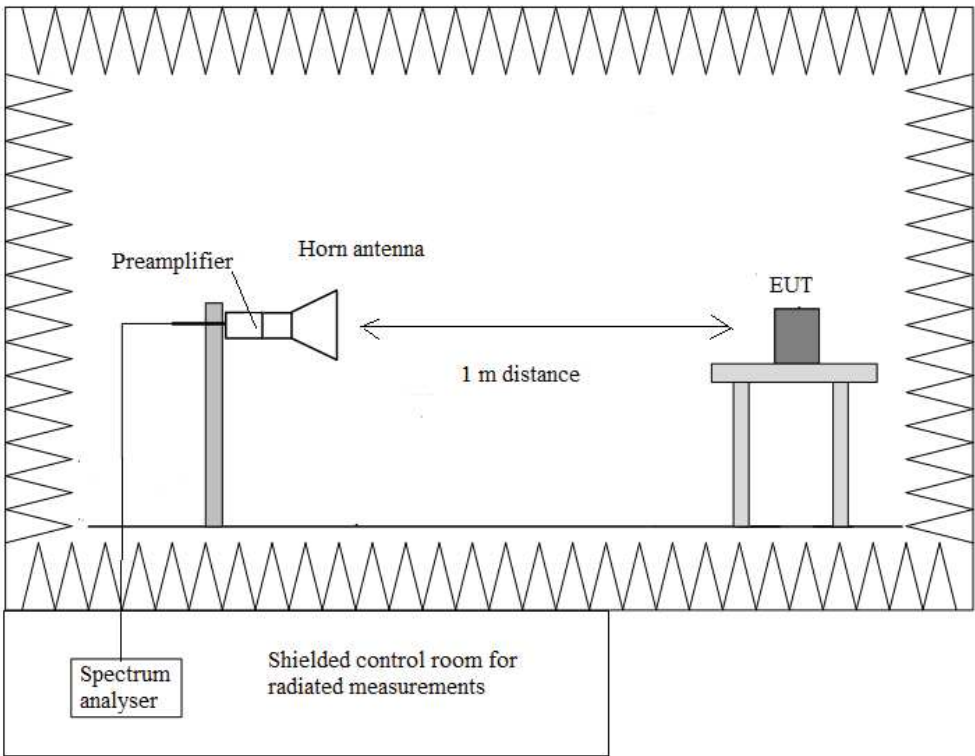
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

- **Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	11.0866	11.0973	11.0726
Measurement uncertainty (kHz)	<± 28.03		

- **Mode 802.11 g**

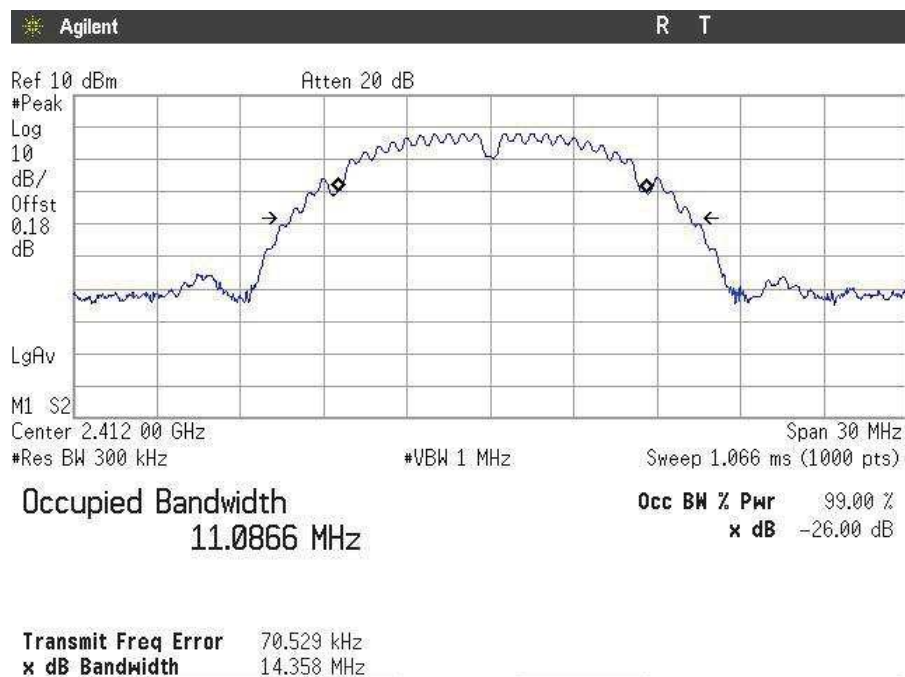
	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	16.9	16.85	16.8
Measurement uncertainty (kHz)	<± 23.08		

- **Mode 802.11 n20**

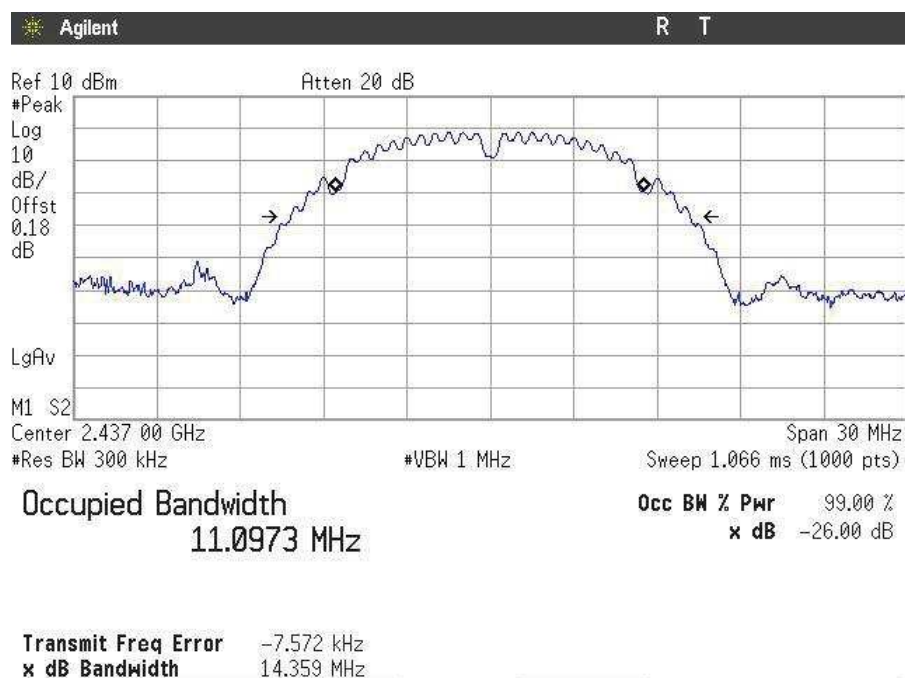
	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	18.08	18.04	18.08
Measurement uncertainty (kHz)	<± 23.08		

- **Mode 802.11 b – Occupied Bandwidth**

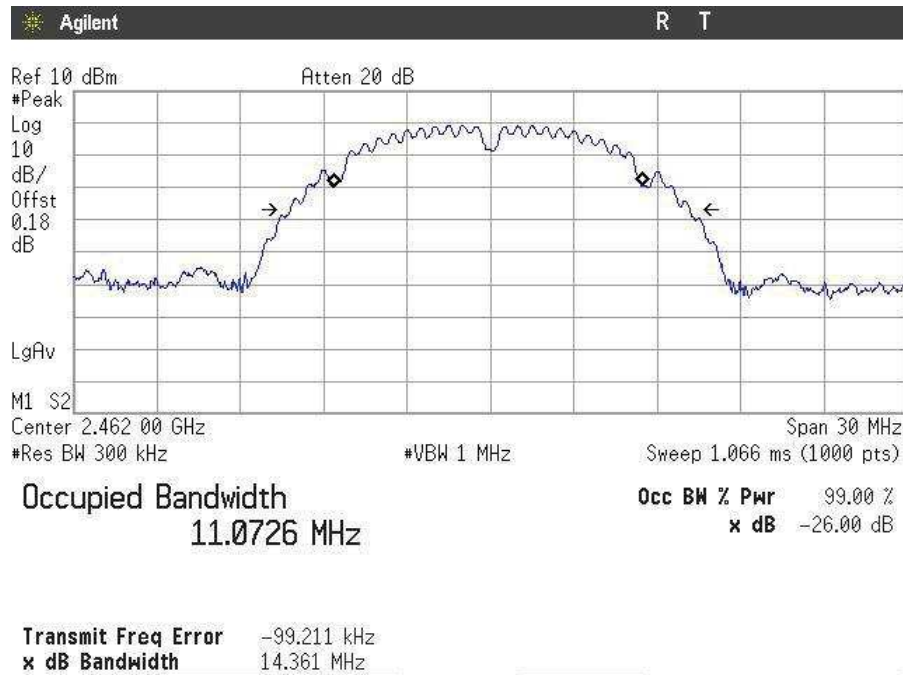
- Low Channel:



- Middle Channel:

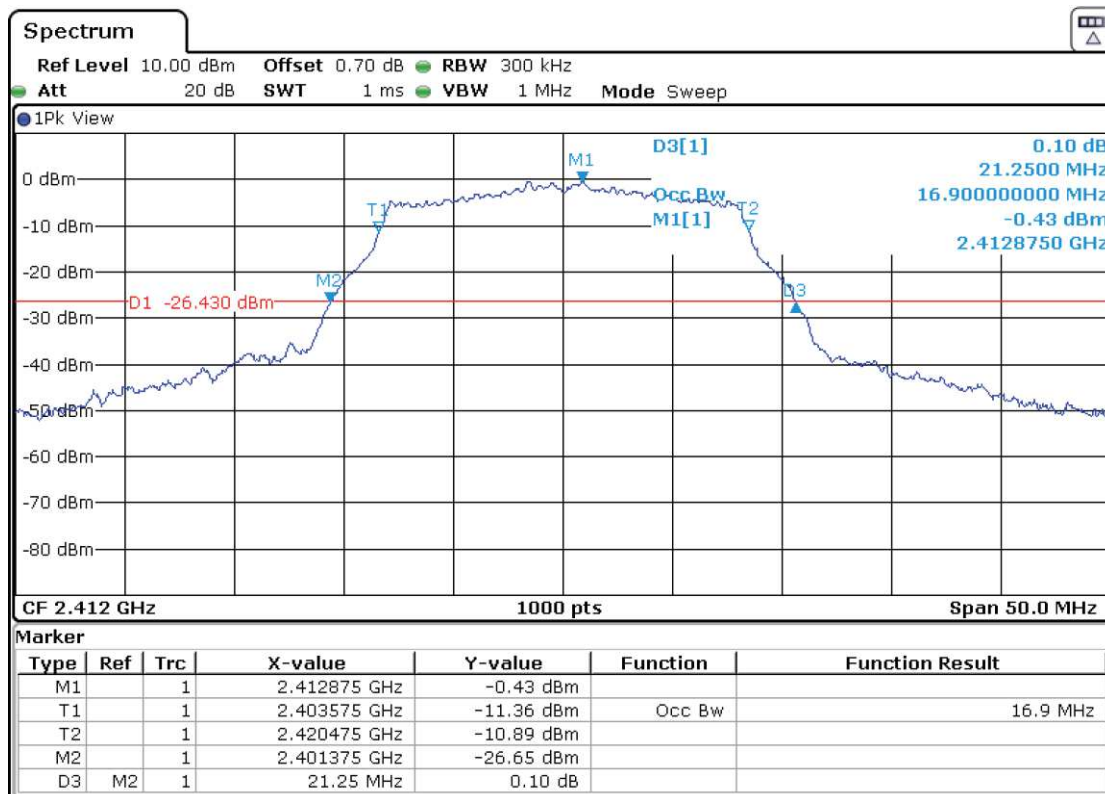


- High Channel:

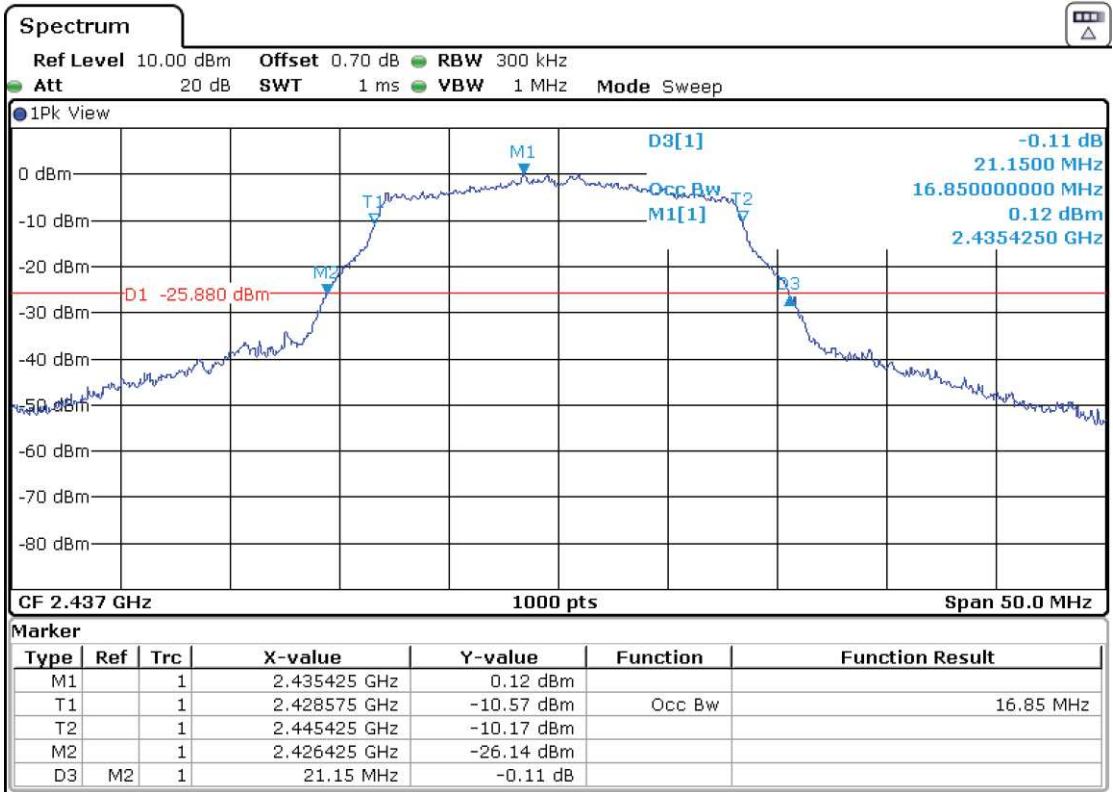


- Mode 802.11 g – Occupied Bandwidth

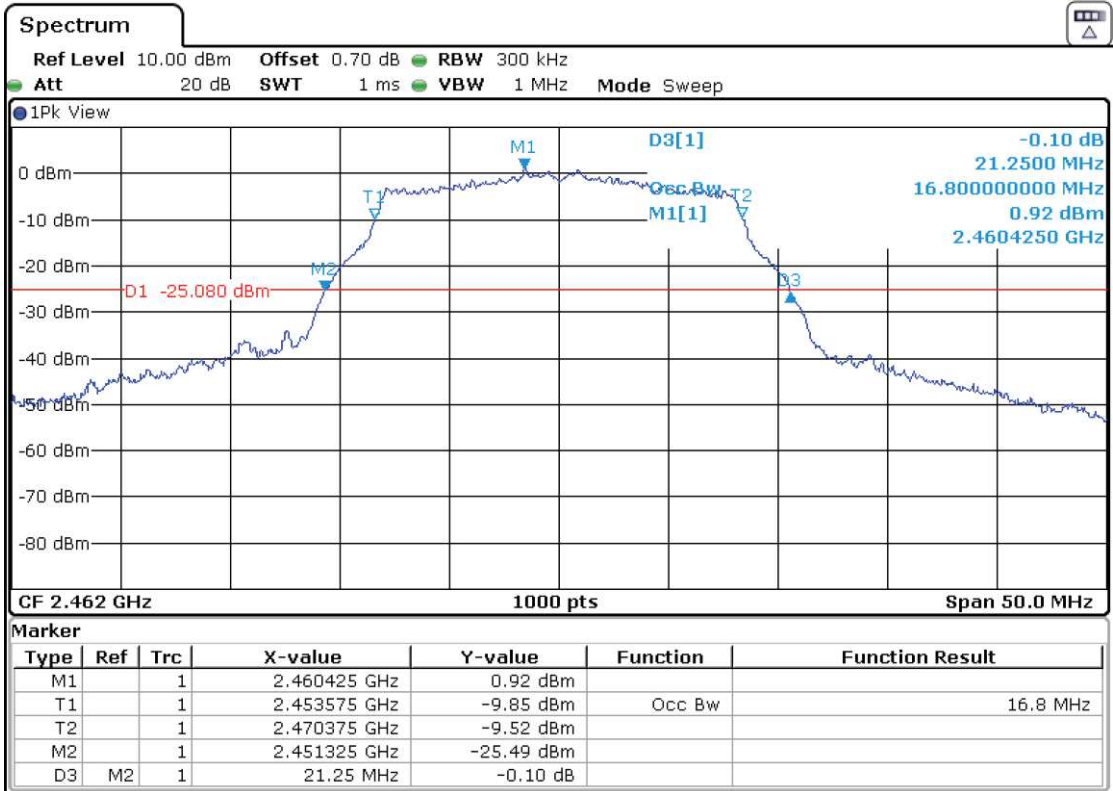
- Low Channel:



- Middle Channel:

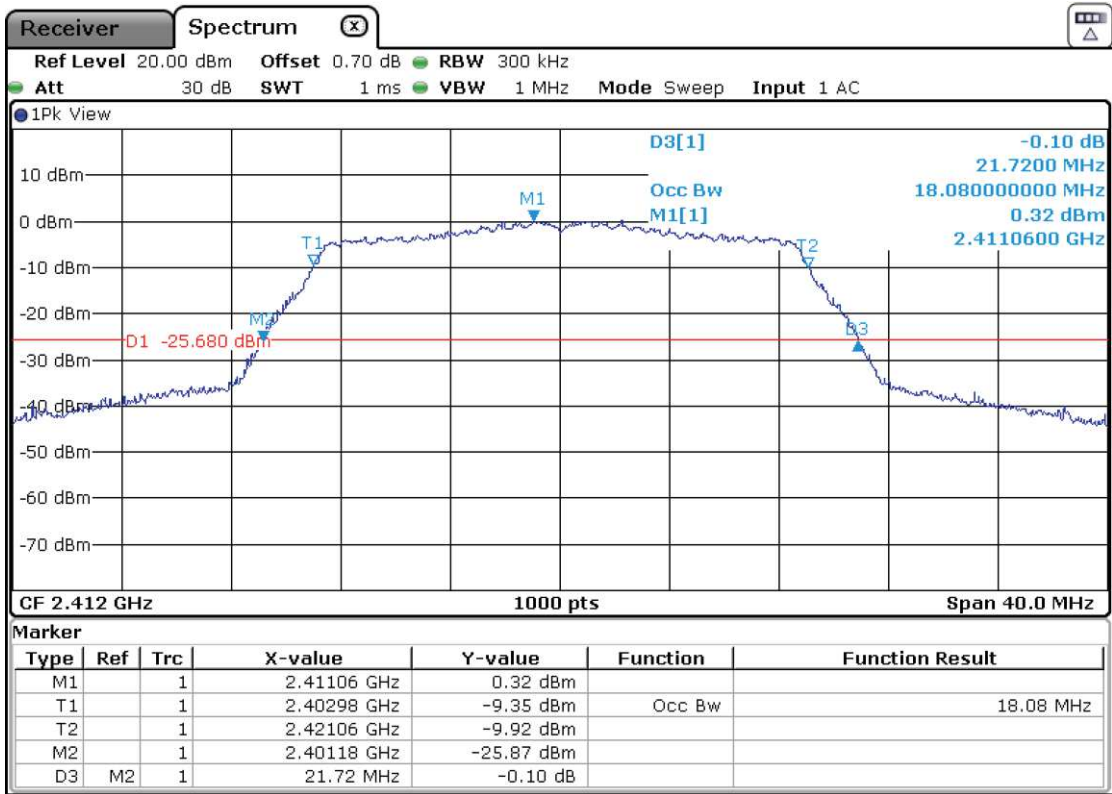


- High Channel:

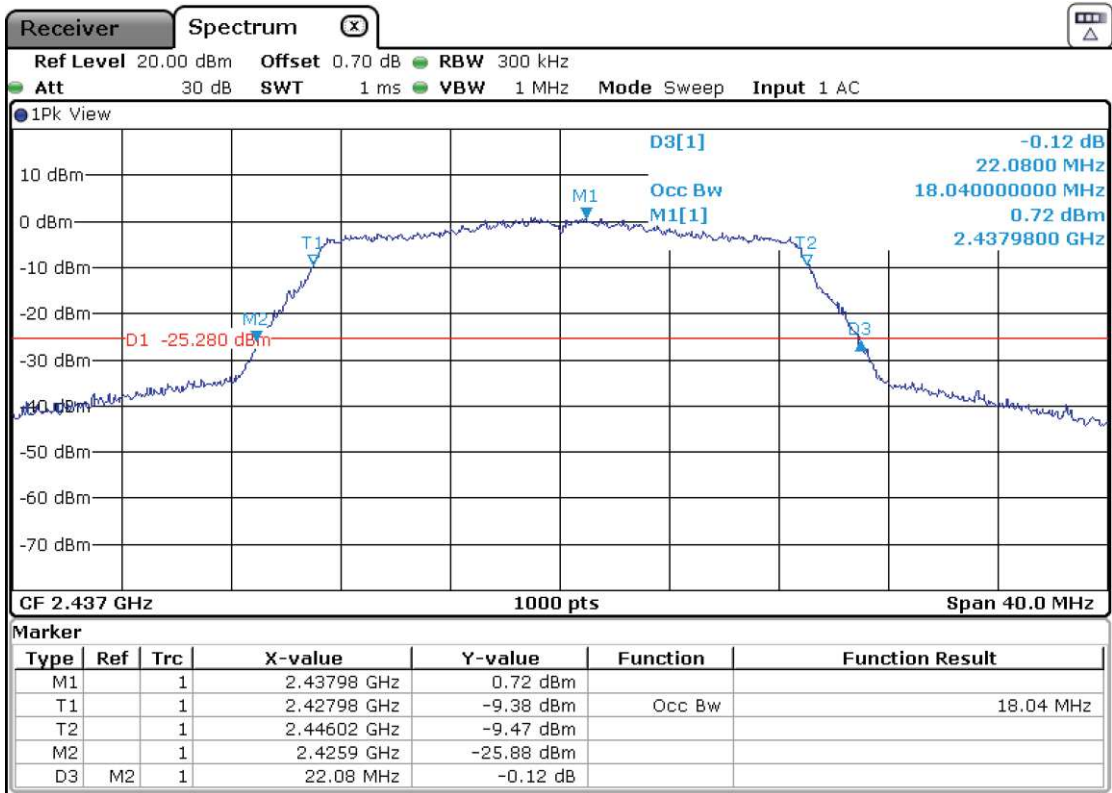


• Mode 802.11 n20 – Occupied Bandwidth

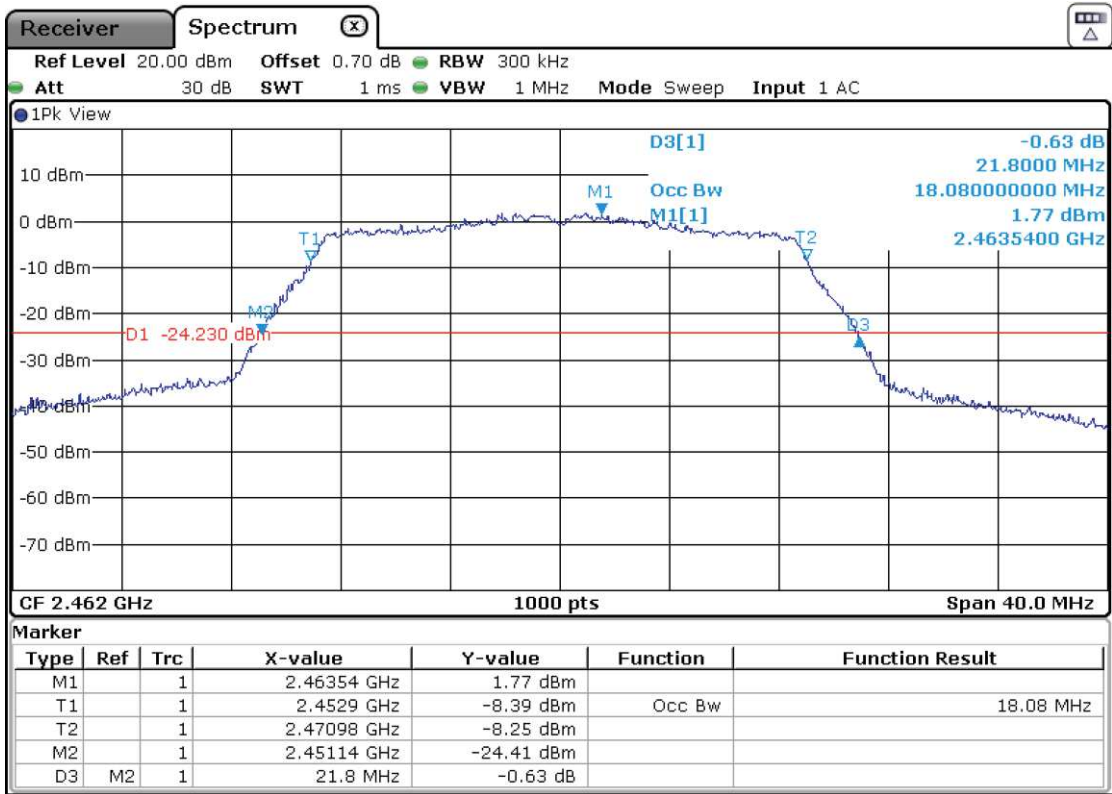
- Low Channel:



- Middle Channel:



- High Channel:



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:

- **Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
6 dB Spectrum Bandwidth (MHz)	8.108	8.148	8.108
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)	16.08	16.35	16.08
Measurement uncertainty (kHz)	<±1.80		

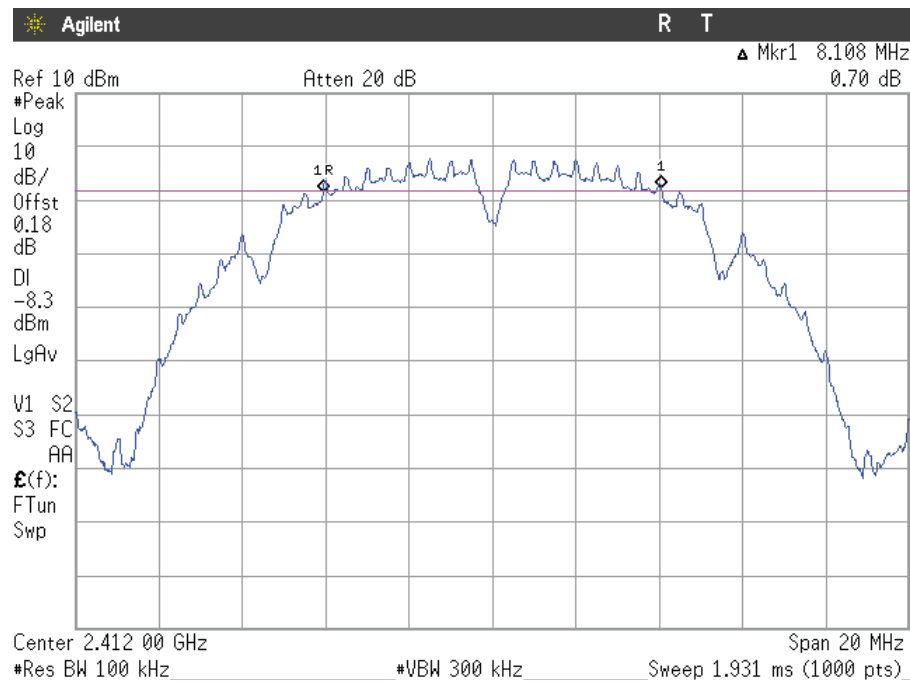
- **Mode 802.11 n20**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
6 dB Spectrum Bandwidth (MHz)	17.505	17.505	17.345
Measurement uncertainty (kHz)	<±1.80		

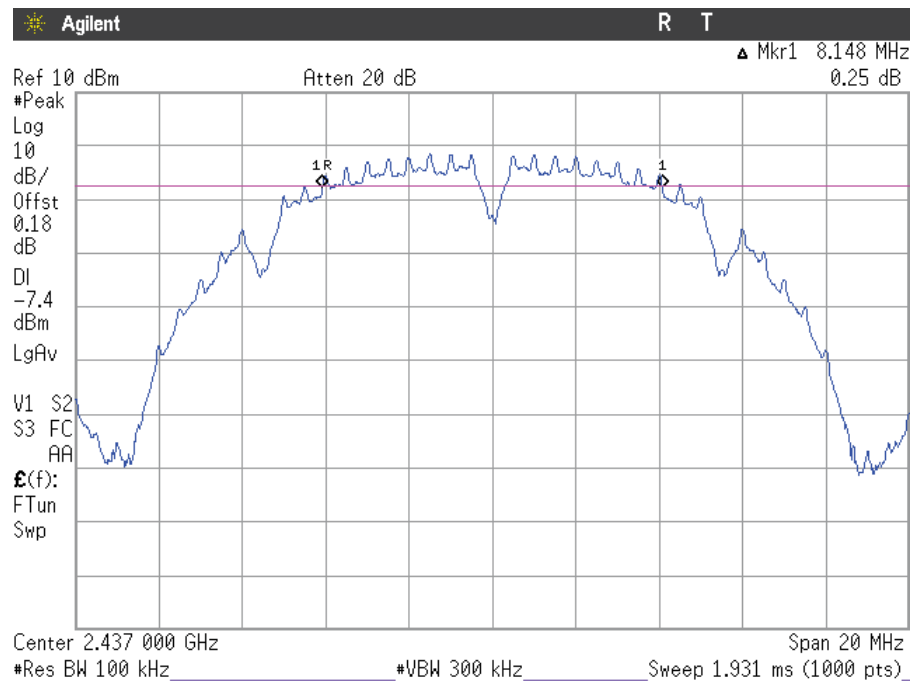
Verdict: PASS

• Mode 802.11 b – 6 dB Bandwidth

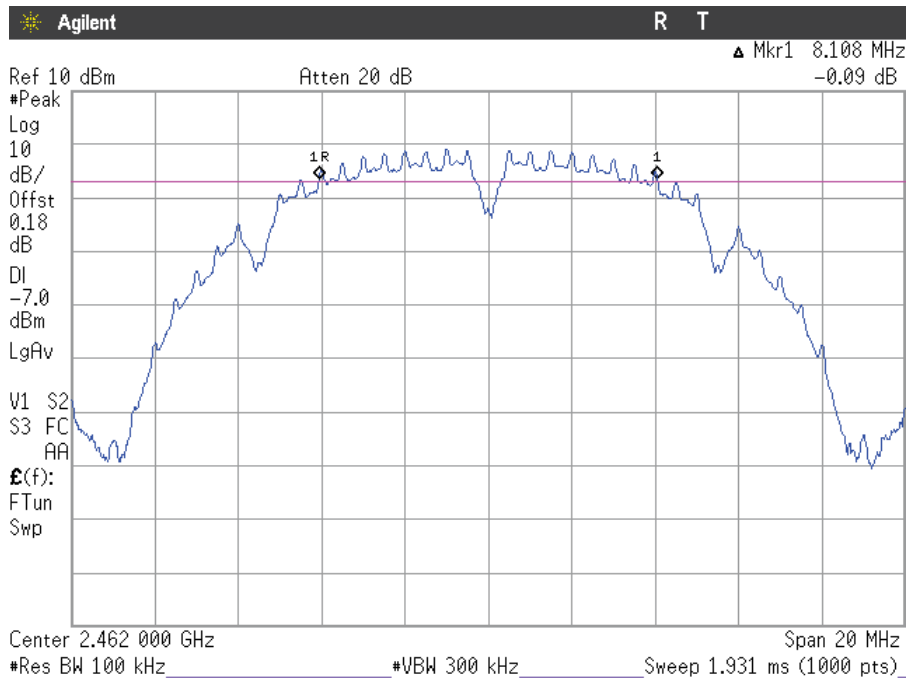
- Low Channel:



- Middle Channel:

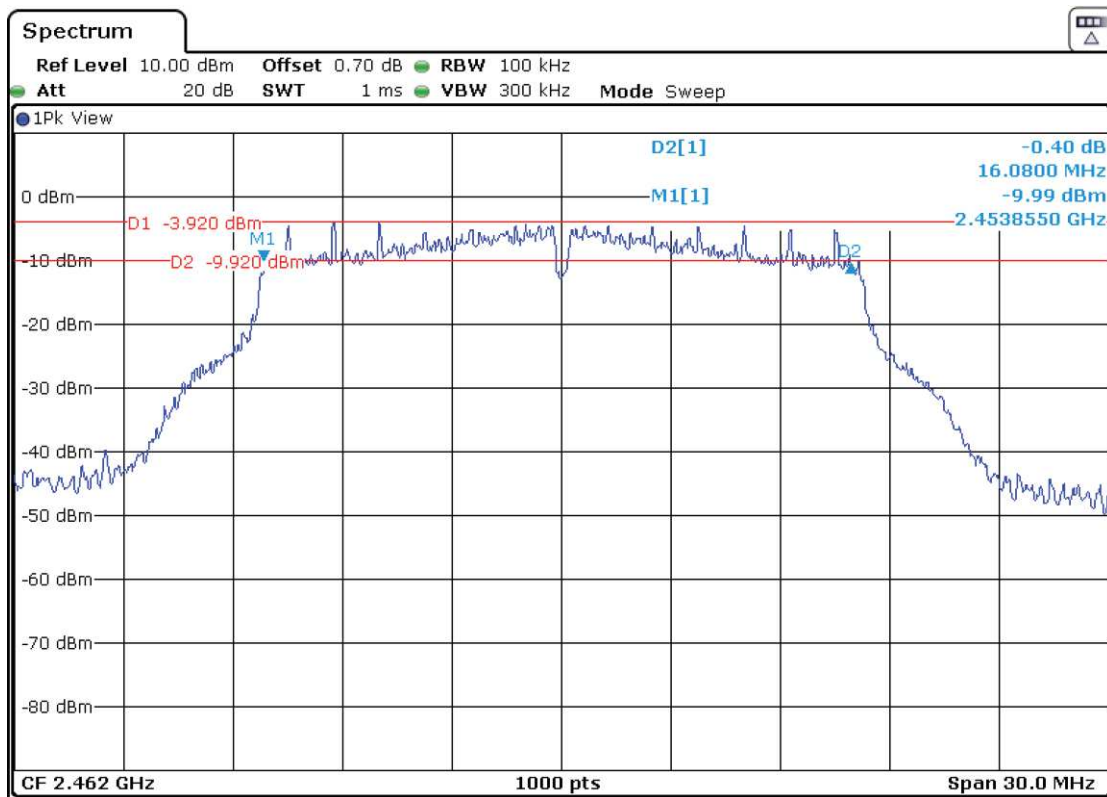


- High Channel:

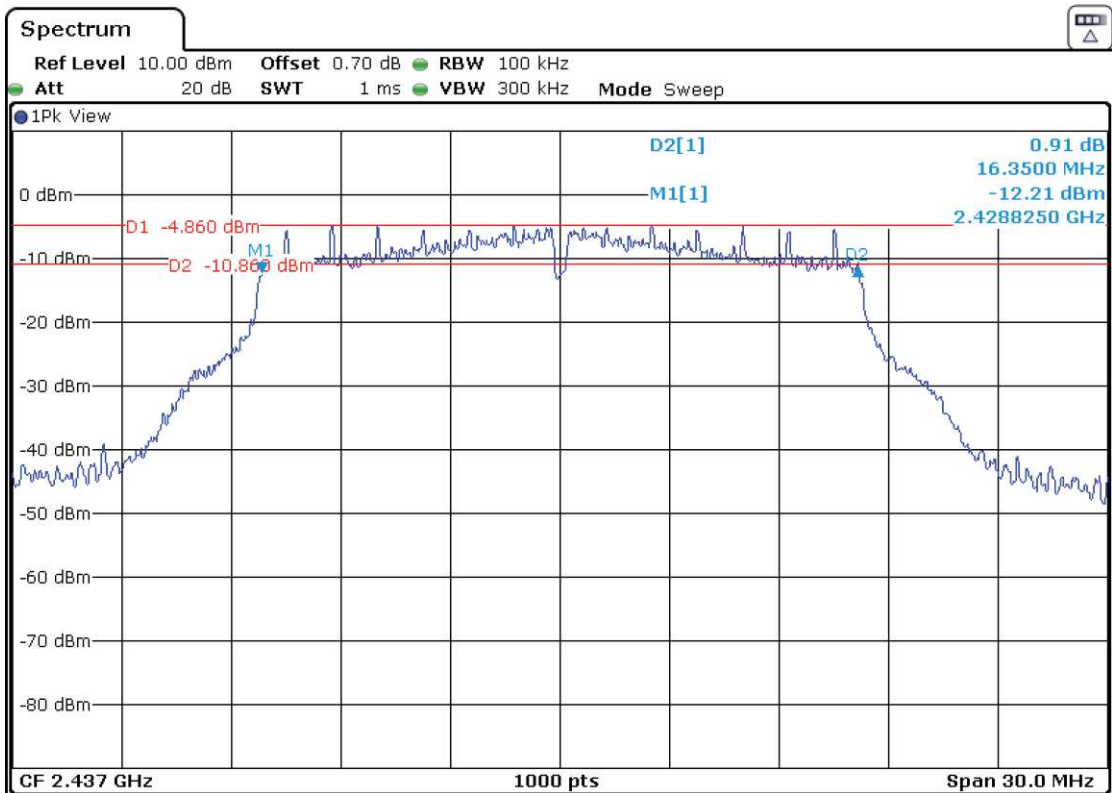


• Mode 802.11 g – 6 dB Bandwidth

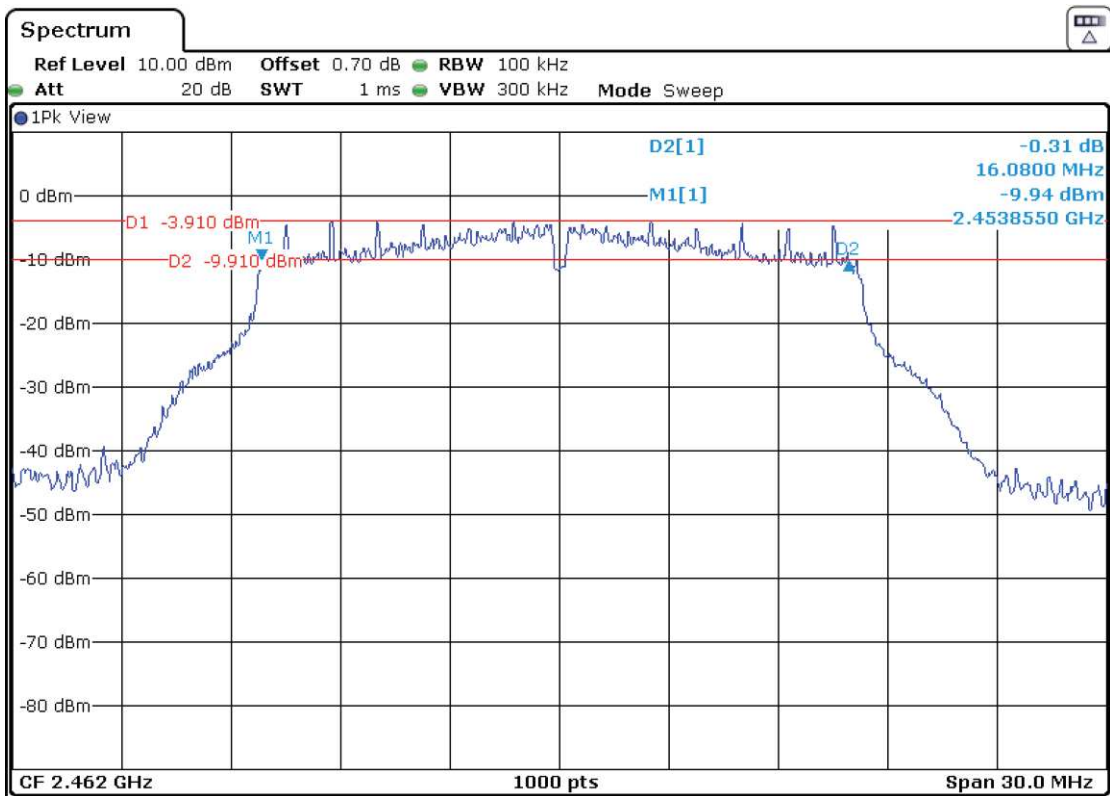
- Low Channel:



- Middle Channel:

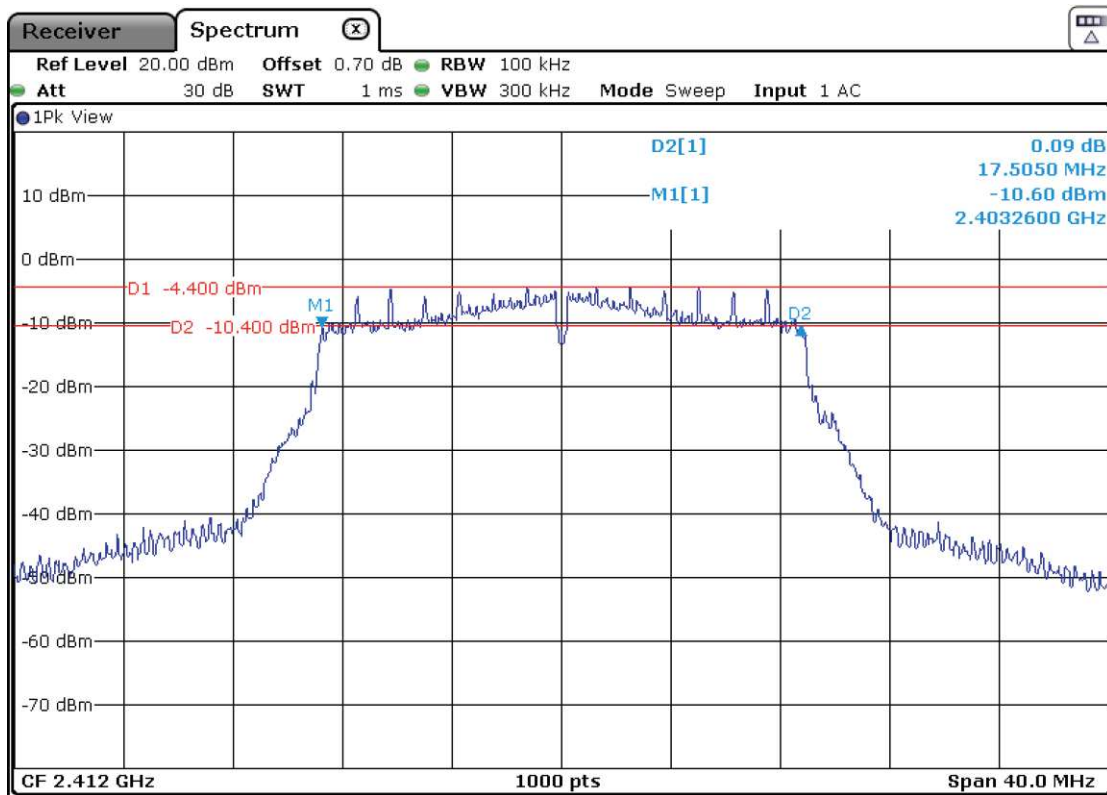


- High Channel:

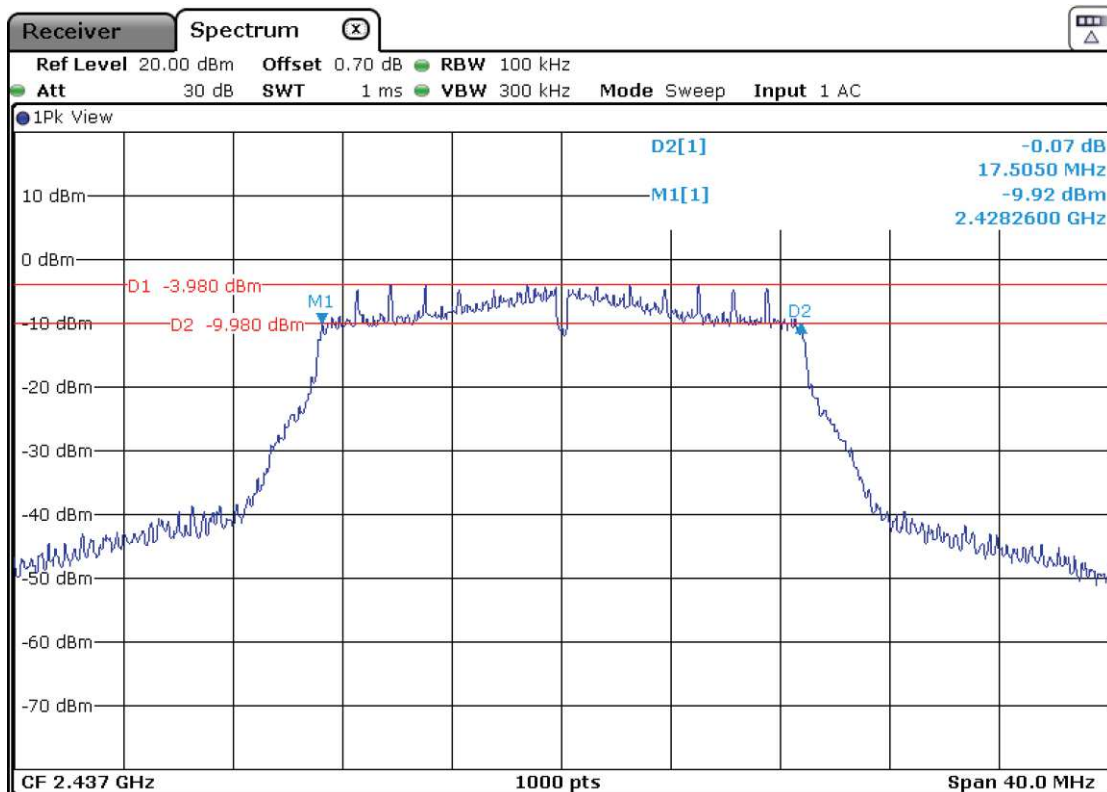


- **Mode 802.11 n20 – 6 dB Bandwidth**

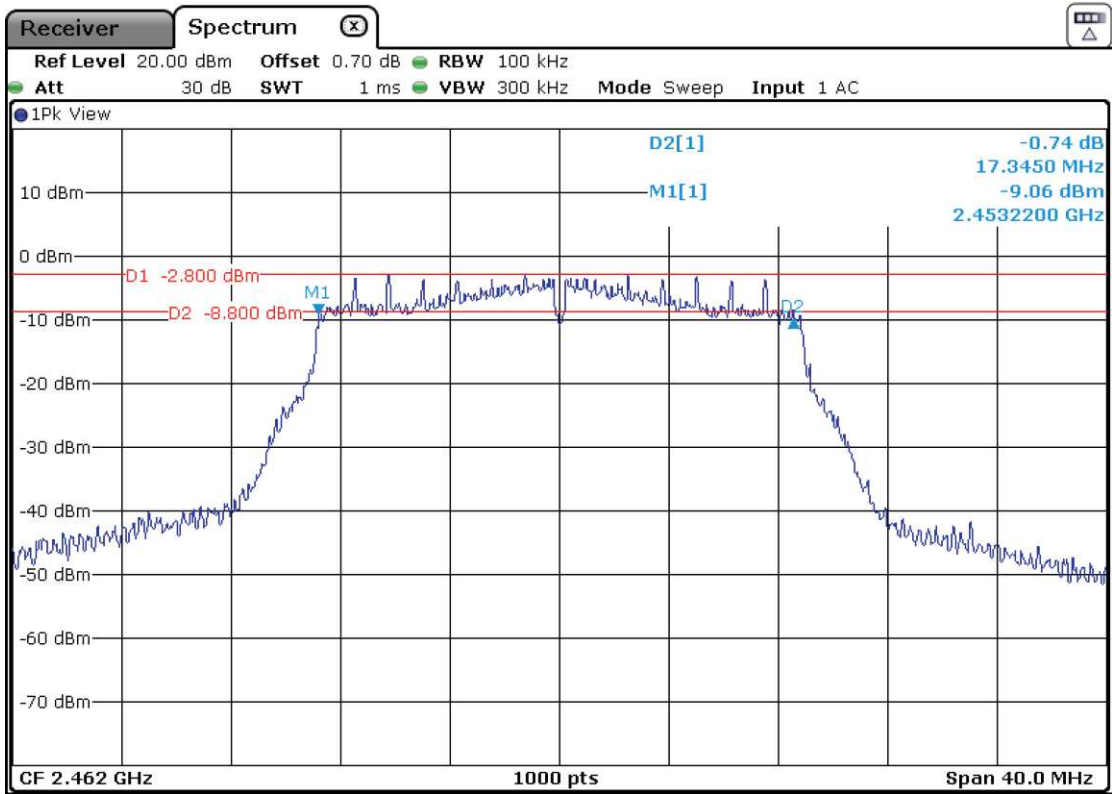
- Low Channel:



- Middle Channel:



- High Channel:



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

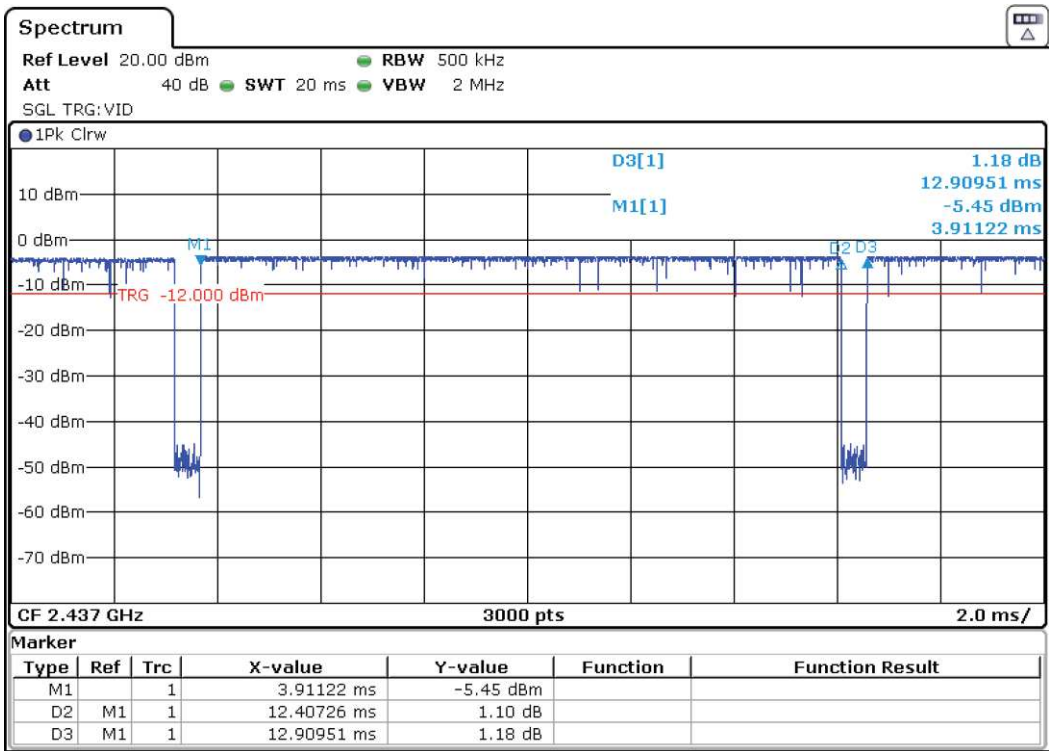
RESULTS:

The transmitter duty cycle is measured using a spectrum analyser in time domain and calculated:

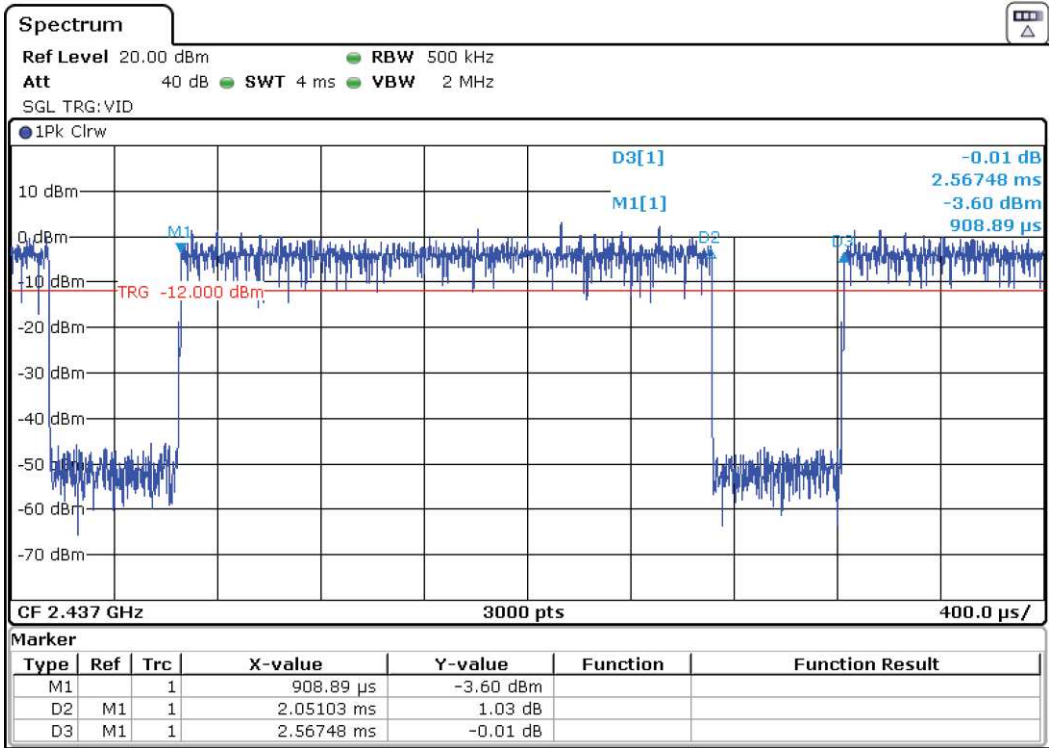
Duty cycle correction: $10 \log (1/ (\text{Pulse duration} / \text{Period}))$

Mode	Pulse duration (ms)	Period (ms)	Duty Cycle correction (dB)
B	12.40726	12.90951	0.172
G	2.05103	2.56748	0.975
N20	1.90698	2.4221	1.038

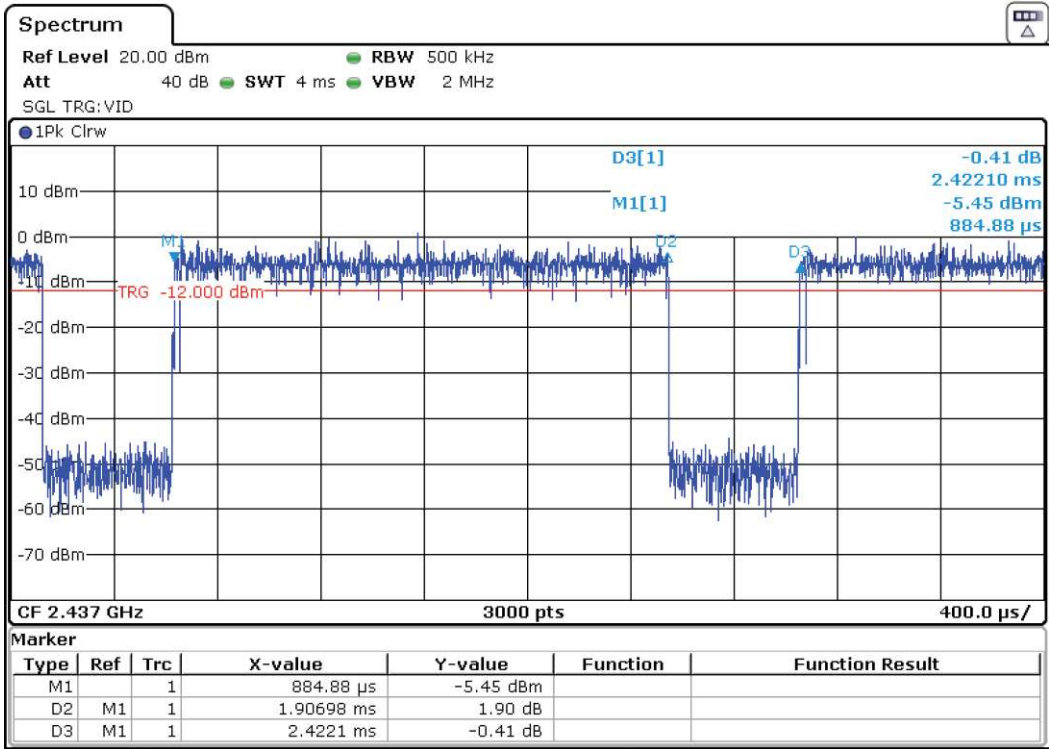
• Mode 802.11 b



• Mode 802.11 g



• Mode 802.11 n20



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 all modes, the maximum conducted output power was measured using the method according to point 11.9.2.2.4 "Method AVGSA-2" 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: 2.2 dBi.

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.

Mode 802.11 b

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Max. Conducted Power (dBm)	7.06	7.59	8.59
Duty Cycle Correction Factor (dB)	0.172	0.172	0.172
Max. Conducted Power corrected (dBm)	7.232	7.762	8.762
Maximum EIRP Power (dBm)	9.604	9.962	10.962
Measurement uncertainty (dB)	<±0.33		

Mode 802.11 g

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Max. Conducted Power (dBm)	7.06	7.63	8.56
Duty Cycle Correction Factor (dB)	0.975	0.975	0.975
Max. Conducted Power corrected (dBm)	8.035	8.605	9.535
Maximum EIRP Power (dBm)	10.235	10.805	11.735
Measurement uncertainty (dB)	<±0.33		

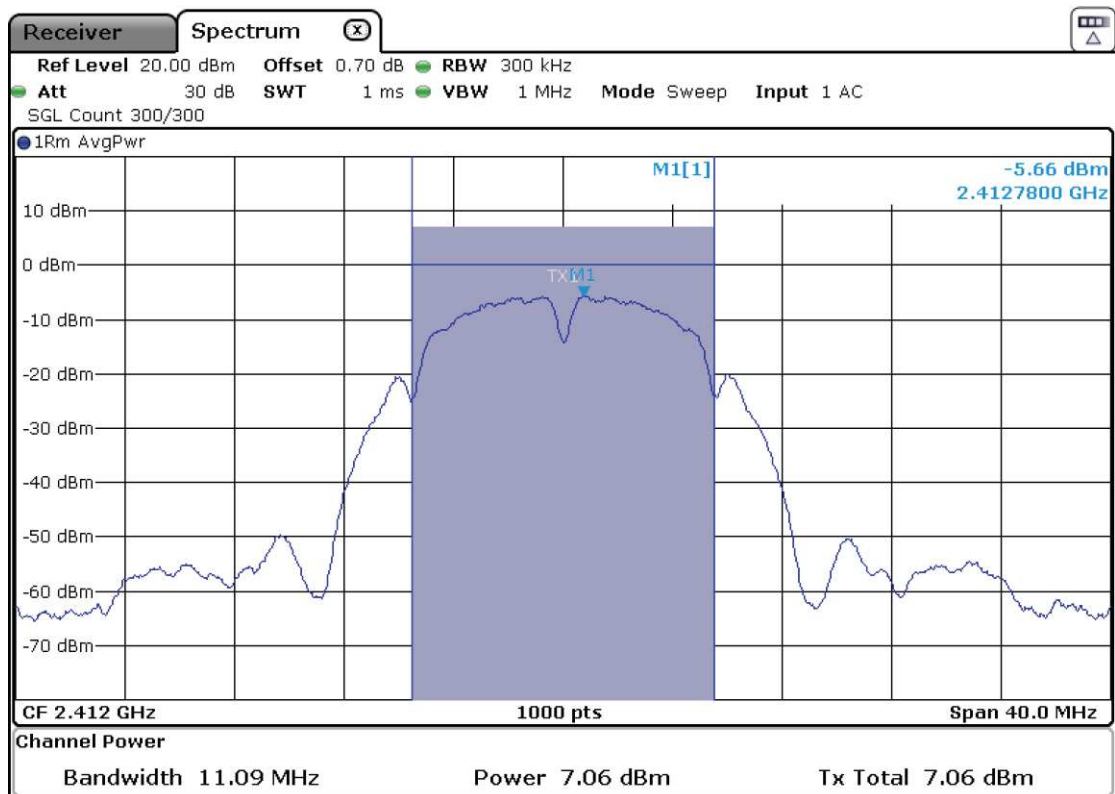
Mode 802.11 n20

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Max. Conducted Power (dBm)	6.48	6.74	7.85
Duty Cycle Correction Factor (dB)	1.038	1.038	1.038
Max. Conducted Power corrected (dBm)	7.518	7.778	8.888
Maximum EIRP Power (dBm)	9.718	9.978	11.088
Measurement uncertainty (dB)	<±0.33		

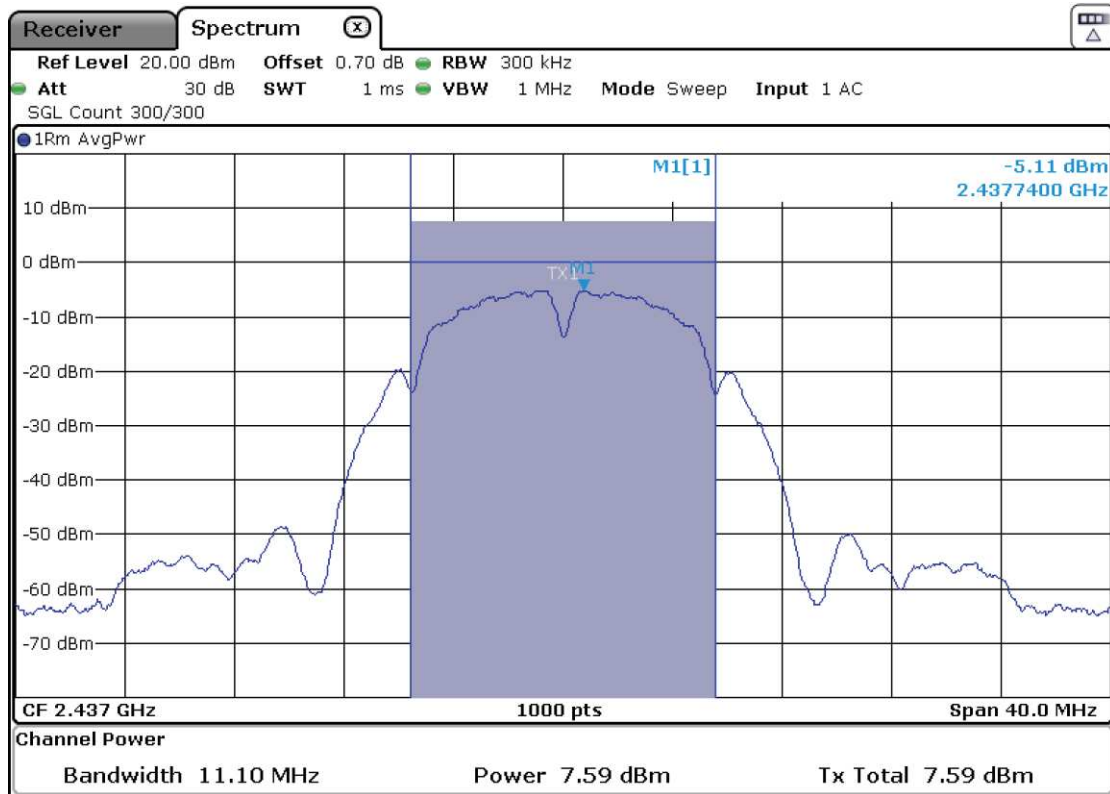
Verdict: PASS

Mode 802.11 b

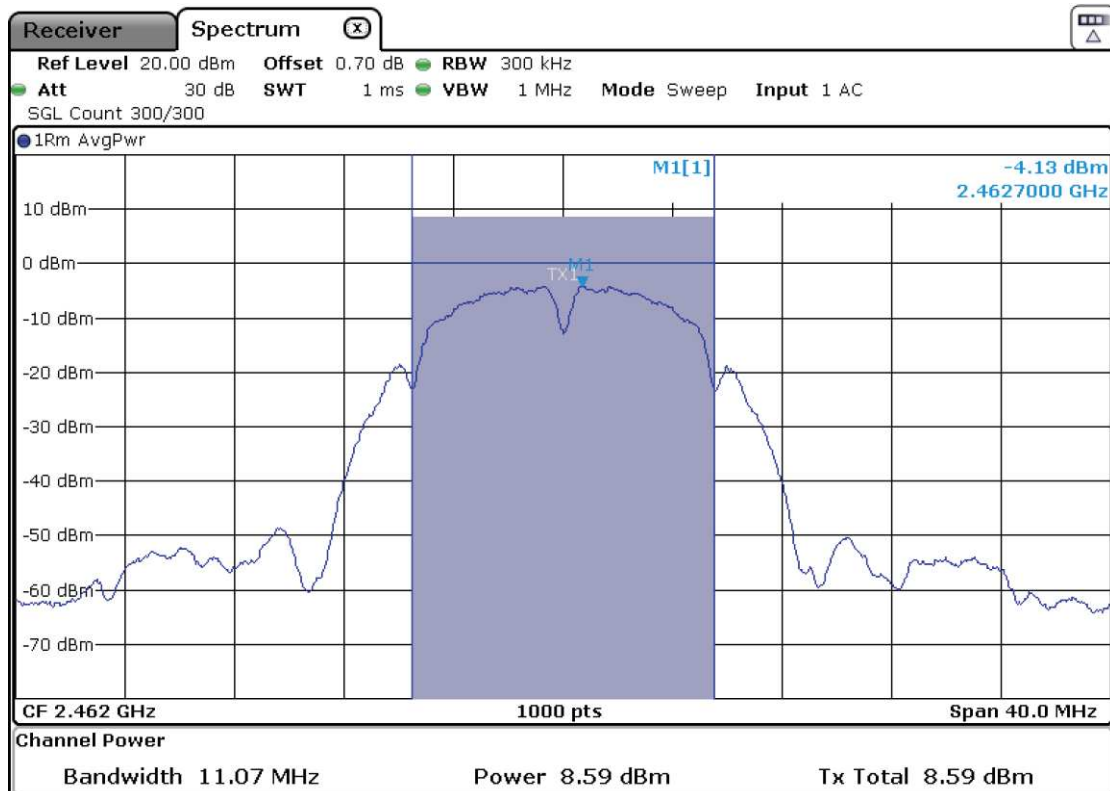
Low Channel:



Middel Channel:

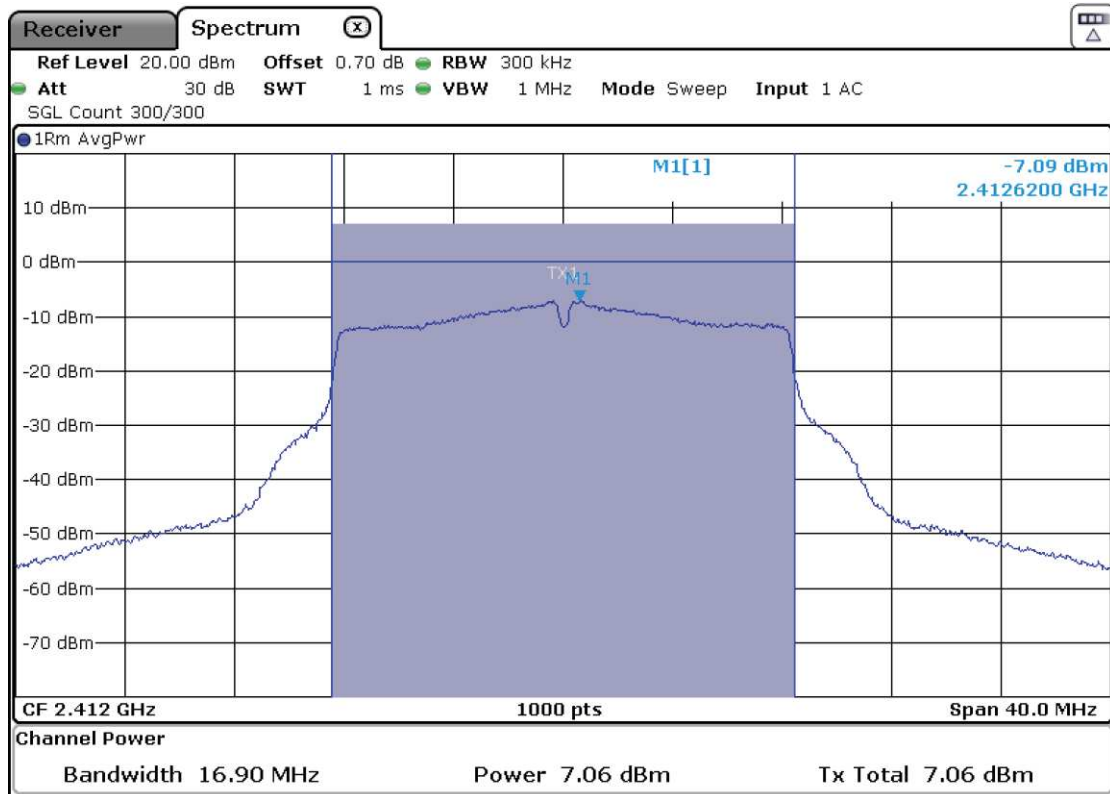


High Channel:

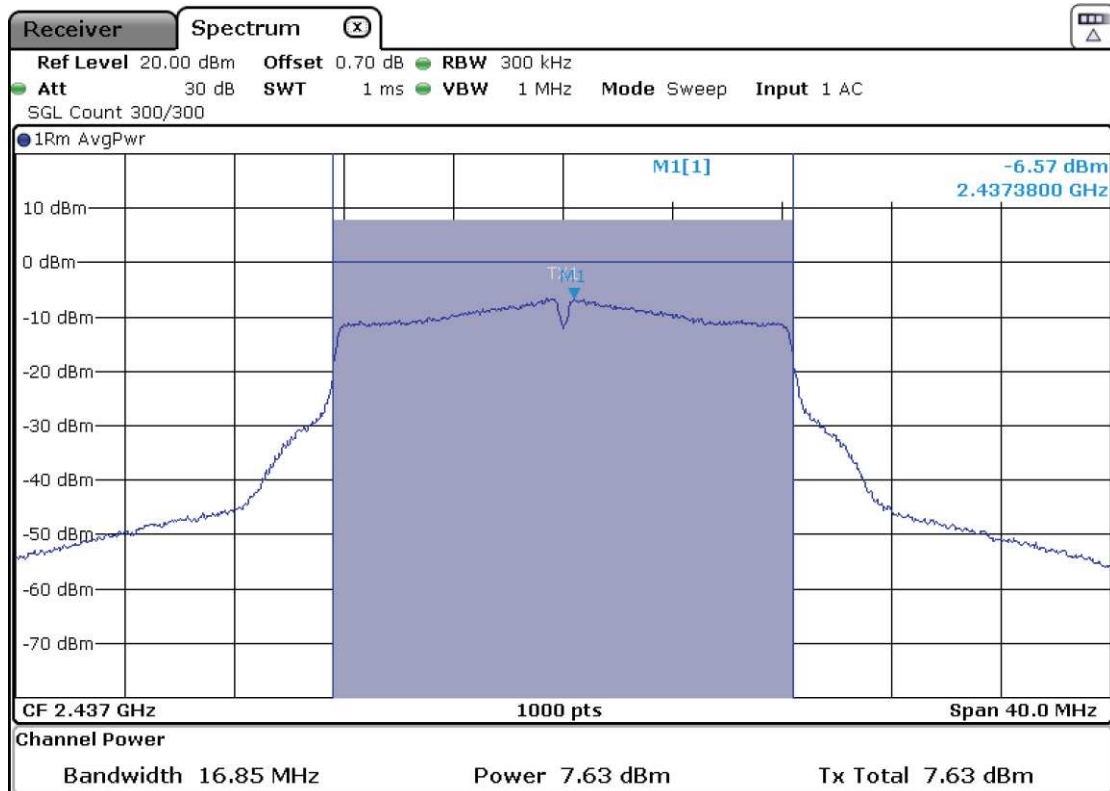


Mode 802.11 g

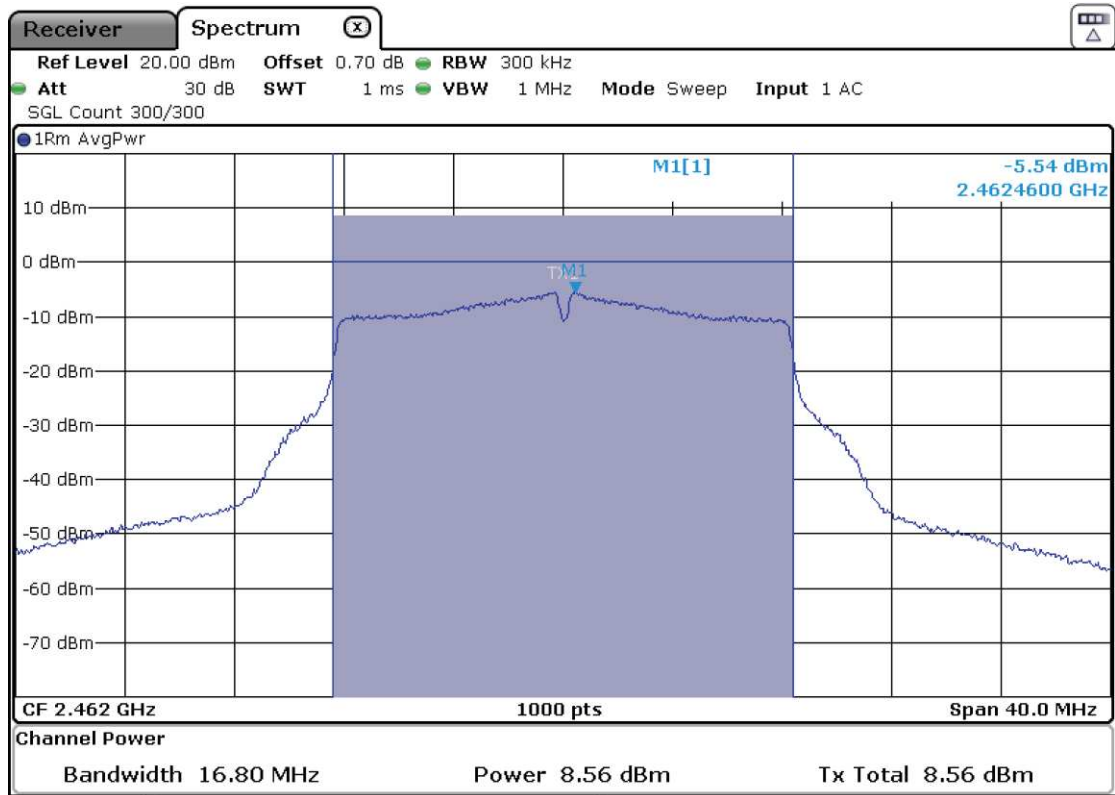
Low Channel:



Middel Channel:

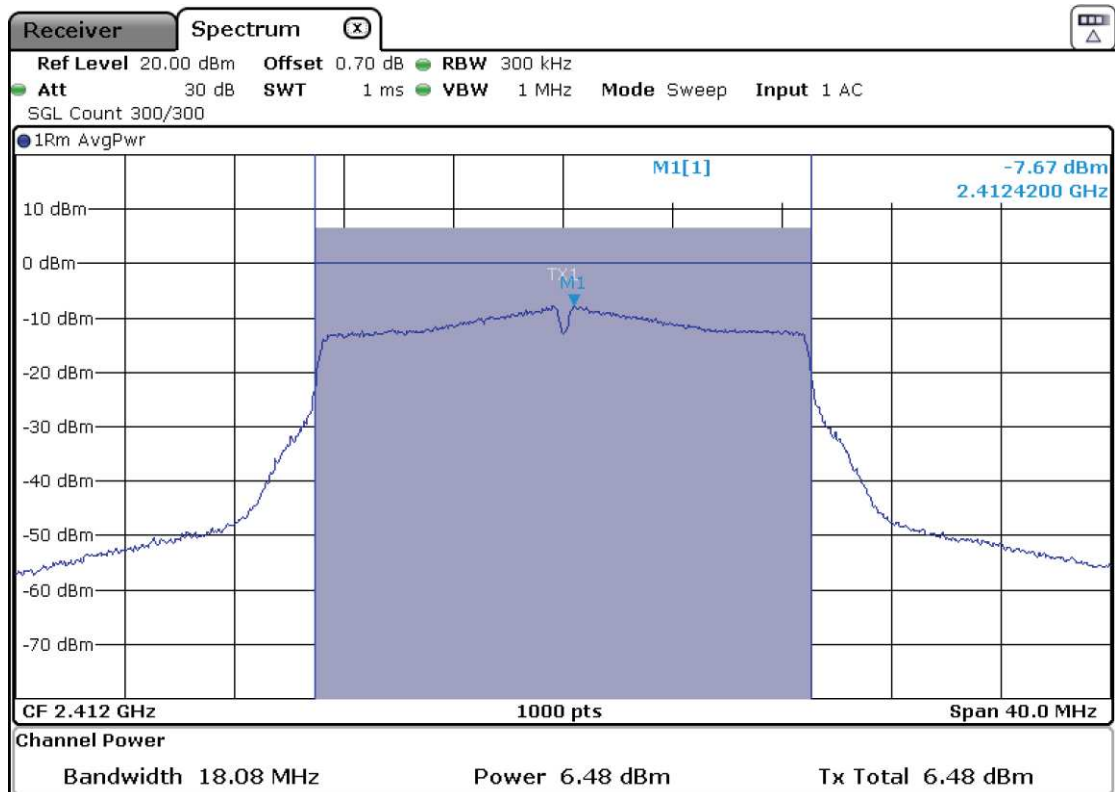


High Channel:

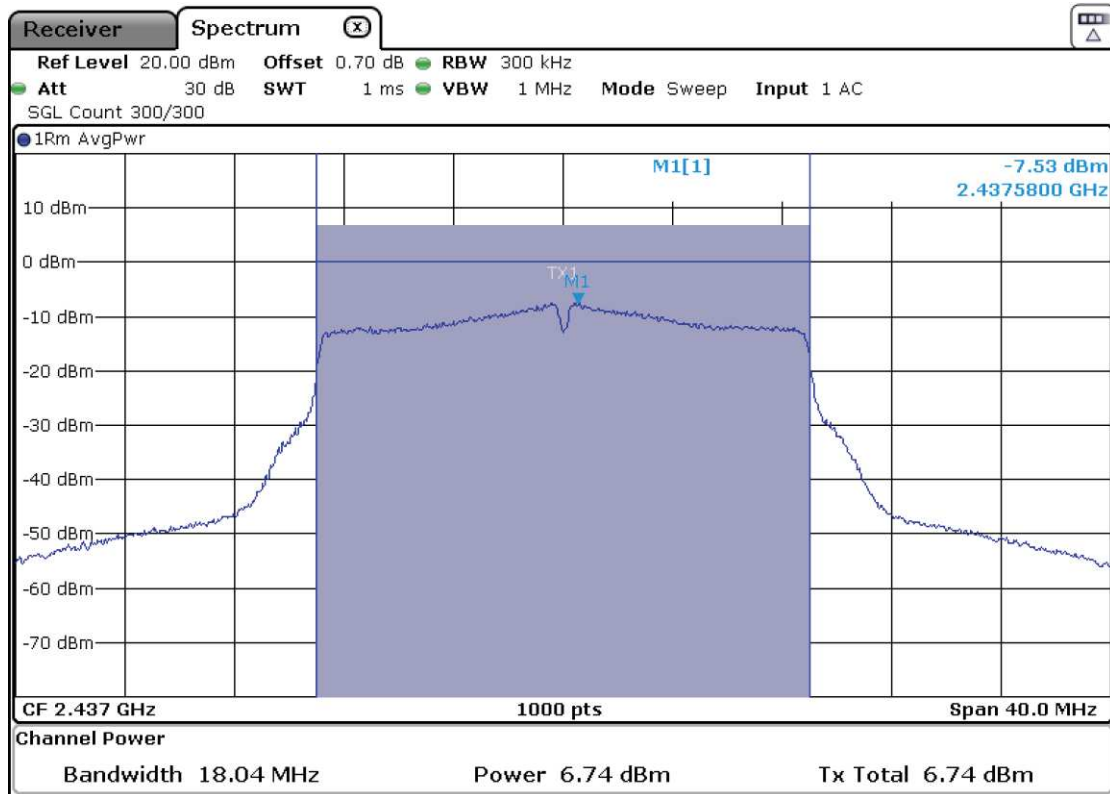


Mode 802.11 n20

Low Channel:



Middel Channel:



High Channel:

