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ASSESSMENT REPORT

Report No.:	44948RRE.002
Approved by (name / position & signature)	Firmado digitalmente por Alejandro Llamas Rodríguez Fecha: 2015.01.21 16:50:21 +01'00'
Issue date	2015-01-21
Identification of item evaluated	INTEL DUAL BAND WIRELESS – AC 3165
Trademark	Not Supplied
Model and/or type reference	3165NGW
Serial number	n/a
Features	802.11 a/b/g/n/ac Wireless LAN + BT 4.0
Other identifications	FCC: PD93165NG (factory install sku) FCC: PD93165NGU (user install allowed) IC: 1000M-3165NG
Description.....	2x2 PCIe M.2 adapter card
Applicant	INTEL MOBILE COMMUNICATIONS
Address	100 Center Point Circle, Suite 200 Columbia, South Carolina 29210 USA
CIF/NIF/Passport.....	Not Supplied
Contact person.....	Steve Hackett
Telephone	803-216-2344
e-mail:	steven.c.hackett@intel.com
Manufacturer	INTEL MOBILE COMMUNICATIONS
Address	100 Center Point Circle, Suite 200 Columbia, South Carolina, 29210 USA
CIF/NIF/Passport.....	Not Supplied
Telephone / Fax.....	803-216-2344

Assessment requested

Evaluation of the possibility of extending the test results of Intel module 7265NGW contained in the test report 41273RRF.002, dated 2014/03/12 to Intel module 3165NGW based on the similarity letter provided by INTEL (See Annex A).

Test Report 41273RRF.002 reference standards are:

USA FCC Part 15.247 10-1-12 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.

USA FCC Part 15.209 10-1-12 Edition: Radiated emission limits; general requirements.

CANADA RSS-210 Issue 8 (December 2010).

CANADA RSS-Gen Issue 3 (December 2010).

Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03r01 dated 09/04/2013.
Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01 dated 10/31/2013.

NOTE: The specifications in the new standard RSS-Gen Issue 4 (November 2014) applicable to the module are the same as the ones specified in the former version RSS-Gen Issue 3 (December 2010).

Report template No .....: FDT70_00

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Competences and guarantees

AT4 wireless guarantees the reliability of the data presented in this report.

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General conditions

1. This report is only referred to the item that has undergone the evaluation.

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3. This assessment report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

Documents used

Documents undergoing used for the evaluation has been provided by: **The applicant**.

Title	Description	Reception date
41273RRF.002	Test Report. reference standard USA FCC Part 15.247, 15.209; CANADA RSS-210, RSS-Gen Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. Licence-Exempt Radio Apparatus (All Frequency Bands): Category I Equipment. General Requirements and Information for the Certification of Radio Apparatus.	2014/12/15
Similarity Declaration letter	Similarity declaration between Intel® Dual Band Wireless-AC 7265, model 7265NGW and Intel® Dual Band Wireless-AC 3165, model 3165NGW	2014/12/15

Summary

Considering the differences between Intel® Dual Band Wireless-AC 7265, model 7265NGW and Intel® Dual Band Wireless-AC 3165, model 3165NGW declared by the client (see Annex A), we conclude that the following test results from 41273RRF.002 test report are fully applicable to model 3165NGW:

Section 15.247 Subclause (a) (2) / RSS-210 A8.2. (a)	6 dB Bandwidth
Section 15.247 Subclause (b) / RSS-210 A8.4. (4)	Maximum output power and antenna gain
Section 15.247 Subclause (d) / RSS-210 A8.5..	Emission limitations conducted (Transmitter)
Section 15.247 Subclause (d) / RSS-210 A8.5.	Band-edge emissions compliance (Transmitter)
Section 15.247 Subclause (e) / RSS-210 A8.2. (b)	Power spectral density
Section 15.247 Subclause (d) / RSS-210 A8.5..	Emission limitations radiated (Transmitter)

For WiFi 2.4 GHz (802.11b/g/n20/n40) and WiFi 5.725 – 5.825 GHz (802.11a/n20/n40/ac80), the results are applicable to only one chain (Chain A or Chain B). The MIMO (Chain A+B) results are not applicable since according to the applicant's declaration MIMO data rates are disabled in model 3165NGW.

See Annex B for test results extracted from 41273RRF.002 test report.

NOTE: The results presented in this Assessment Report apply only to the particular item under evaluation established in page 1 of this document.

ANNEX A: Similarity Declaration letter

Similarity Declaration between:

Intel® Dual Band Wireless-AC 7265, model 7265NGW

And

Intel® Dual Band Wireless-AC 3165, model 3165NGW.

To whom it may concern,

This statement letter is to declare that the two following products are exactly the same board, meaning same HW, same schematic, same layout, same BoM:

- Intel® Dual Band Wireless-AC 7265, model 7265NGW
- Intel® Dual Band Wireless-AC 3165, model 3165NGW

The only difference is disabling by EEprom all MIMO data rate for Intel® Dual Band Wireless-AC 3165, model 3165NGW (Please refer to below table for detailed data rate listing comparison)

Model 7265NGW supports 2 spatial streams and **Model 3165NGW** supports only 1 spatial stream.

IEEE 802.11n/ac Modulation Coding Schemes

HT MCS Index	Modulation and Coding Rate	Spatial Streams	Data Rate (MBPS)						VHT MCS Index
			20 MHz Chan		40 MHz Chan		80 MHz Chan		
			No SGI	SGI	No SGI	SGI	No SGI	SGI	
0	BPSK 1/2	1	6.5	7.2	13.5	15.0	29.3	32.5	0
1	QPSK 1/2	1	13.0	14.4	27.0	30.0	58.5	65.0	1
2	QPSK 3/4	1	19.5	21.7	40.5	45.0	87.8	97.5	2
3	16-QAM 1/2	1	26.0	28.9	54.0	60.0	117.0	130.0	3
4	16-QAM 3/4	1	39.0	43.3	81.0	90.0	175.5	195.0	4
5	64-QAM 2/3	1	52.0	57.8	108.0	120.0	234.0	260.0	5
6	64-QAM 3/4	1	58.5	65.0	121.5	135.0	263.3	292.5	6
7	64-QAM 5/6	1	65.0	72.2	135.0	150.0	292.5	325.0	7
	256-QAM 3/4	1	78.0	86.7	162.0	180.0	351.0	390.0	8
	256-QAM 5/6	1	n/a	n/a	180.0	200.0	390.0	433.3	9
8	BPSK 1/2	2	13.0	14.4	27.0	30.0	58.5	65.0	0
9	QPSK 1/2	2	26.0	28.9	54.0	60.0	117.0	130.0	1
10	QPSK 3/4	2	39.0	43.3	81.0	90.0	175.5	195.0	2
11	16-QAM 1/2	2	52.0	57.8	108.0	120.0	234.0	260.0	3
12	16-QAM 3/4	2	78.0	86.7	162.0	180.0	351.0	390.0	4
13	64-QAM 2/3	2	104.0	115.6	216.0	240.0	468.0	520.0	5
14	64-QAM 3/4	2	117.0	130.0	243.0	270.0	526.5	585.0	6
15	64-QAM 5/6	2	130.0	144.4	270.0	300.0	585.0	650.0	7
	256-QAM 3/4	2	156.0	173.3	324.0	360.0	702.0	780.0	8
	256-QAM 5/6	2	n/a	n/a	360.0	400.0	780.0	866.7	9

Authorized signature by:

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ANNEX B: Test results that apply to model 3165NGW

ANNEX B CONTENT:

Test results “WiFi 2.4 GHz (802.11b/g/n20/n40)”

TEST CONDITIONS

Power supply (V):

$V_{nominal}$ = 3.3 Vdc

Type of power supply = DC voltage from HMC/NGFC test board.

Type of antenna = External attachable PIFA antenna.

Declared Gain for antenna = 3.24 dBi

TEST FREQUENCIES:

For WiFi 802.11b/g/n20:

Lowest channel (1): 2412 MHz

Middle channel (6): 2437 MHz

Highest channel (11): 2462 MHz

Additional channels (12) and (13): 2467 MHz and 2472 MHz, respectively, for information purposes only.

For WiFi 802.11n40:

Lowest channel (3): 2422 MHz

Middle channel (6): 2437 MHz

Highest channel (9): 2452 MHz

Additional channels (10F) and (11F): 2457 MHz and 2462 MHz, respectively, for information purposes only.

The test set-up was made in accordance to the general provisions of FCC DTS Measurement KDB 558074 D01 DTS Meas Guidance v03r01.

For 802.11b/g modes the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually but not simultaneously.

For 802.11n modes 802.11n20 (20 MHz channel bandwidth) and 802.11n40 (40MHz channel bandwidth) the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually and simultaneously.

For radio testing purposes the card was installed in a test fixture. The test fixture is connected to a laptop computer and dc power supplied. The laptop computer was used to configure the EUT to continuously transmit at a specified output power with different modes and modulation schemes.

WiFi 2.4 GHz: 802.11b, 802.11g, 802.11n20 (20 MHz channel bandwidth) and 802.11n40 (40MHz channel bandwidth).

The field strength at the band edges was evaluated for each mode and on each chain individually on the lowest and highest channels at the rated power for the channel under test. Where the power at the edge channels was lower than the power at the center channels additional measurements were made at the adjacent channels. Single transmission at each chain and simultaneous transmission at both chains modes were fully evaluated.

The PC was using the Intel test utility DRTU Version 1.7.3-859.

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

The data rates of 1Mb/s for 802.11b, 6Mb/s for 802.11g, HT0 (SISO)/HT8 (MIMO) for 802.11n20 and n40 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.

The conducted RF output power at each chain was adjusted according to the client's supplied Target values (see following table) using the Intel DRTU tool and measuring the power by using a calibrated average power meter. Measured values for adjustment were within -0.2 dB/+0.3 dB respect to the Target values.

RF conducted output power target values

Mode	BW (MHz)	Channel / Freq.	SISO Chain A (dBm)	SISO Chain B (dBm)	MIMO at both ports A and B (dBm)
802.11b	20	1 / 2412	16,5	16,5	n/a
		6 / 2437	17,5	17,5	n/a
		11 / 2462	16,5	16,5	n/a
		12 / 2467	12	13.5	n/a
		13 / 2472	11	12.5	n/a
802.11g	20	1 / 2412	14	14,5	n/a
		2 / 2417	15,5	15,5	n/a
		6 / 2437	17,5	17,5	n/a
		10 / 2457	15,5	15,5	n/a
		11 / 2462	12,5	12,5	n/a
		12 / 2467	10	9	n/a
		13 / 2472	0	0	n/a
802.11n	20	1 / 2412	14	14,5	12,00
		2 / 2417	15,5	15,5	13,50
		6 / 2437	17,5	17,5	17,50
		10 / 2457	15,5	15,5	13,50
		11 / 2462	12,5	12,5	12,00
		12 / 2467	10	9	7,00
		13 / 2472	0	0	0,00
802.11n*	40	3 / 2422	13,5	13,5	9,50
		4 / 2427	14,5	14,5	11,50
		5 / 2432	15,5	15,5	12,00
		6 / 2437	17,5	17,5	13,50
		7 / 2442	14,5	13,5	11,50
		8 / 2447	13,5	12,5	10,50
		9 / 2452	12,5	11,5	9,50
		10F / 2457	10	9	7,00
		11F / 2462	0	0	0,00

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a calibrated low loss RF cable. The reading in the spectrum analyser is compensated with the cable loss at each measurement frequency.

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 1m 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 (wooden) platform one meter 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.

Occupied Bandwidth

RESULTS

1. WiFi 2.4GHz 802.11 b mode

Occupied Bandwidth (see next plots).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
99% bandwidth (MHz)	12.75	12.54	12.72	12.81	12.66	12.75
Measurement uncertainty (kHz)	±21.7					

2. WiFi 2.4GHz 802.11 g mode

Occupied Bandwidth (see next plots).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
99% bandwidth (MHz)	16.53	16.83	16.98	17.22	16.80	16.44
Measurement uncertainty (kHz)	±21.7					

3. WiFi 2.4GHz 802.11 n20 mode

Occupied Bandwidth (see next plots).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
99% bandwidth (MHz)	17.37	17.91	18.03	18.36	17.91	17.91
Measurement uncertainty (kHz)	±21.7					

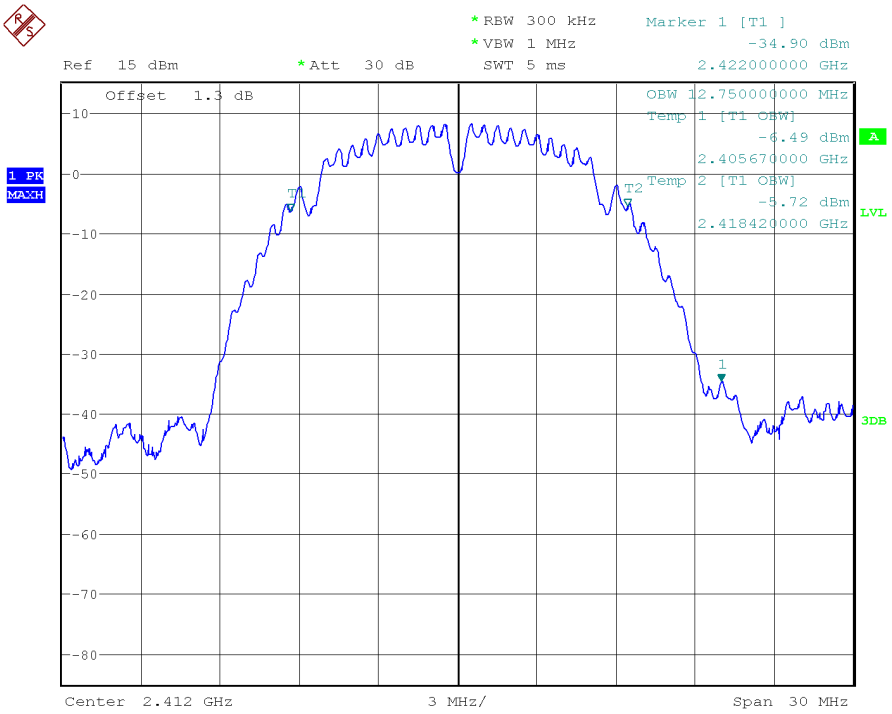
4. WiFi 2.4GHz 802.11 n40 mode

Occupied Bandwidth (see next plots).

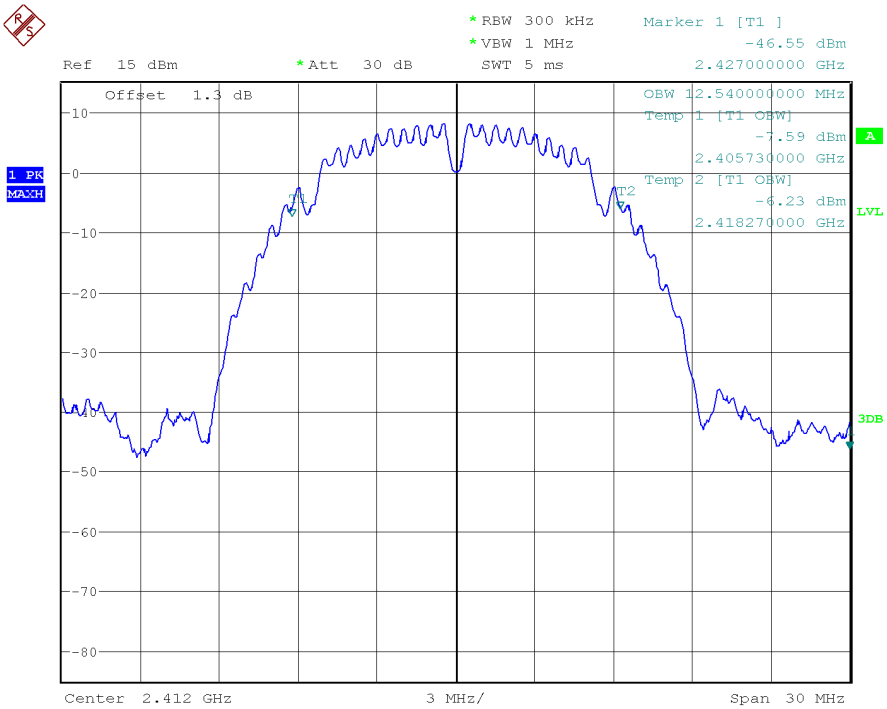
	Lowest frequency 2422 MHz		Middle frequency 2437 MHz		Highest frequency 2452 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
99% bandwidth (MHz)	36.20	36.22	36.35	36.35	36.20	36.15
Measurement uncertainty (kHz)	±21.7					

1. WiFi 2.4GHz 802.11 b mode

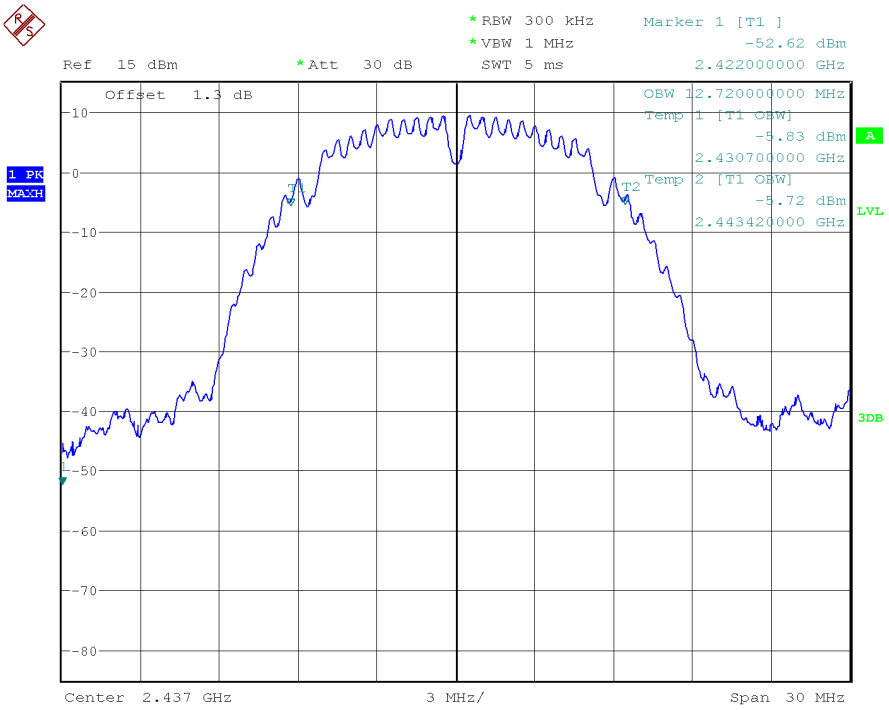
Lowest Channel: 2412 MHz. Chain A



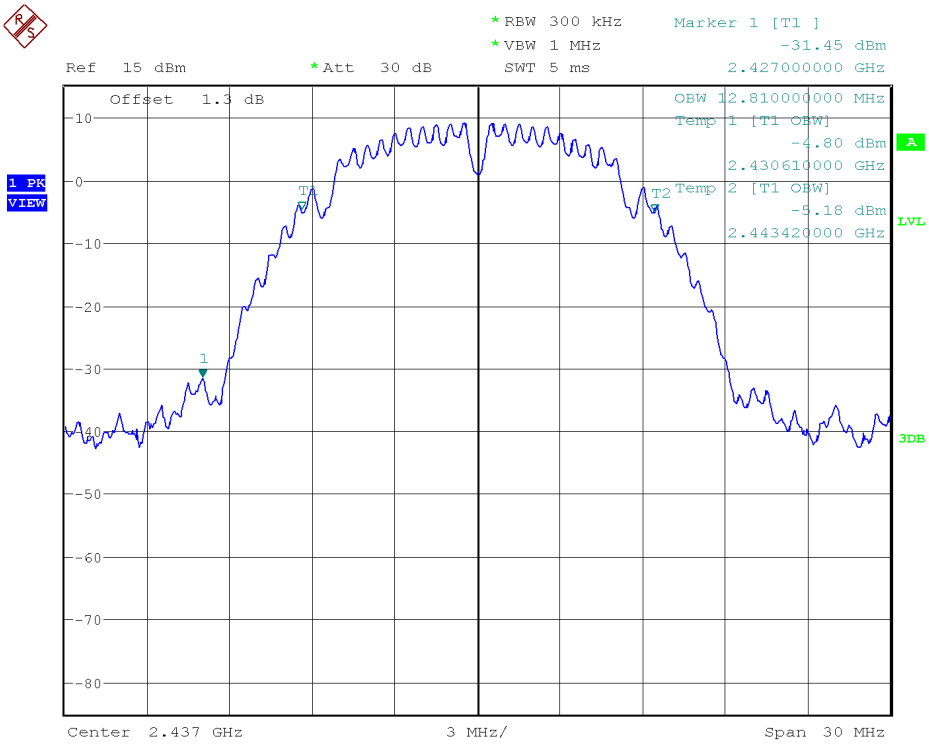
Lowest Channel: 2412 MHz. Chain B.



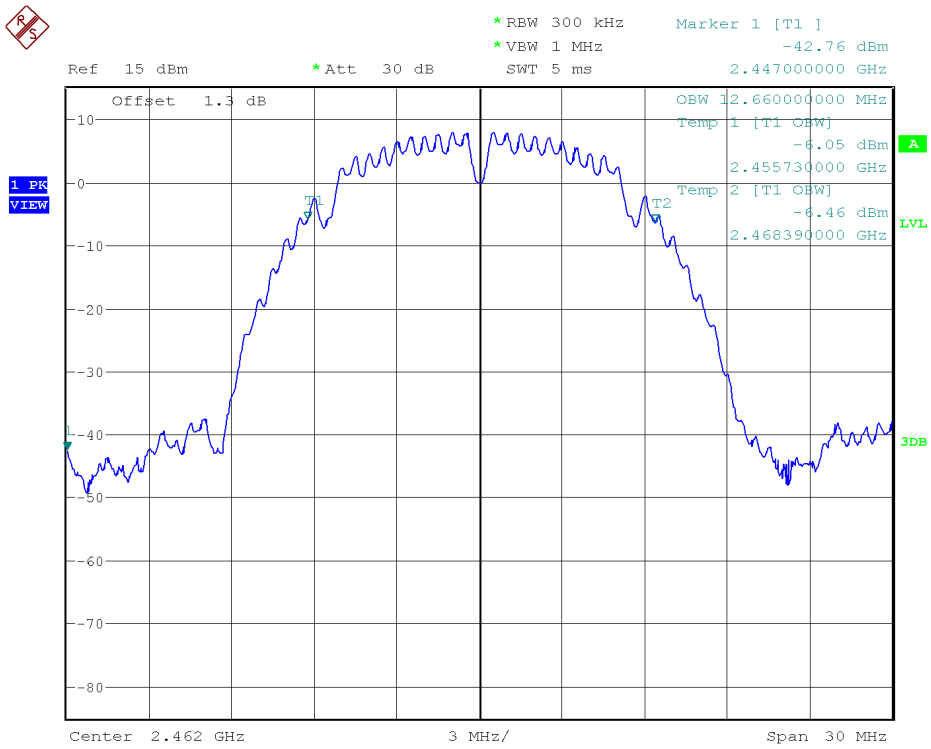
Middle Channel: 2437 MHz. Chain A



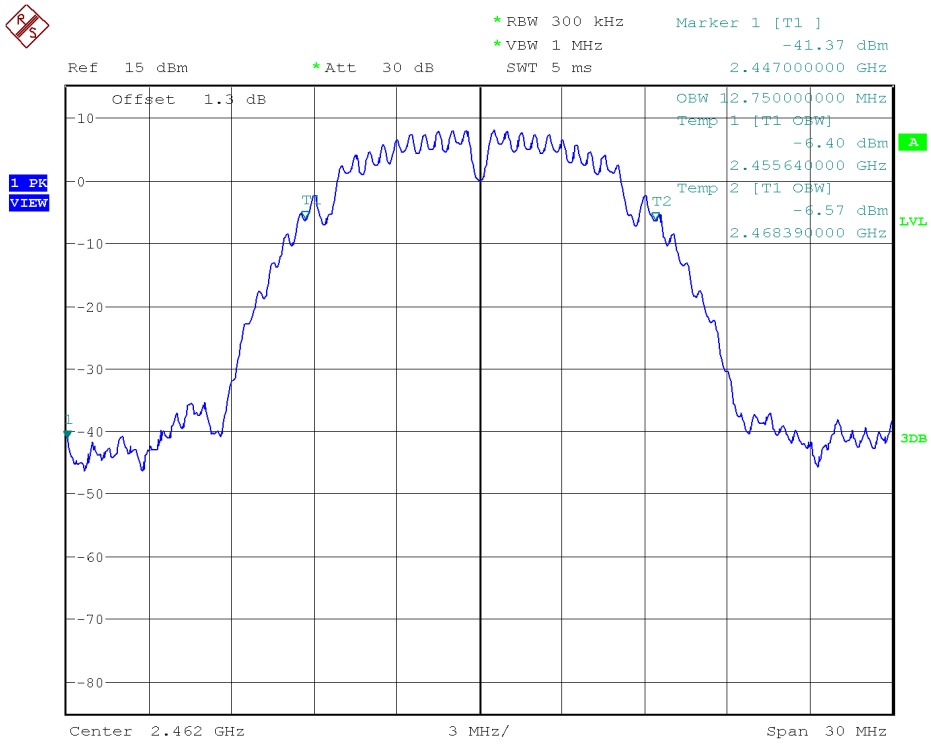
Middle Channel: 2437 MHz. Chain B



Highest Channel: 2462 MHz. Chain A.

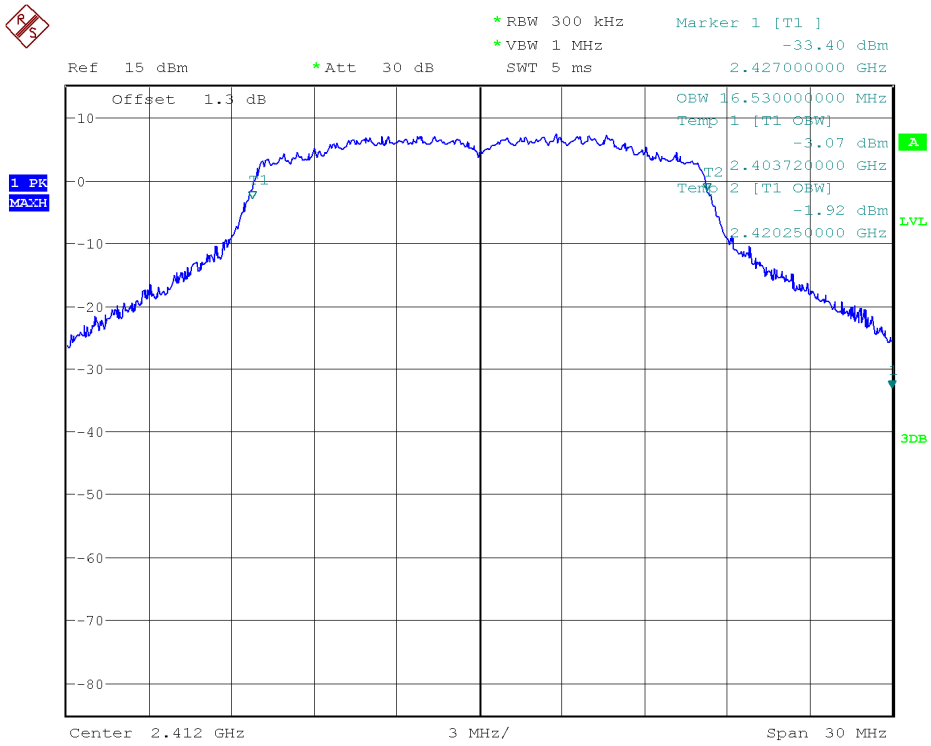


Highest Channel: 2462 MHz. Chain B.

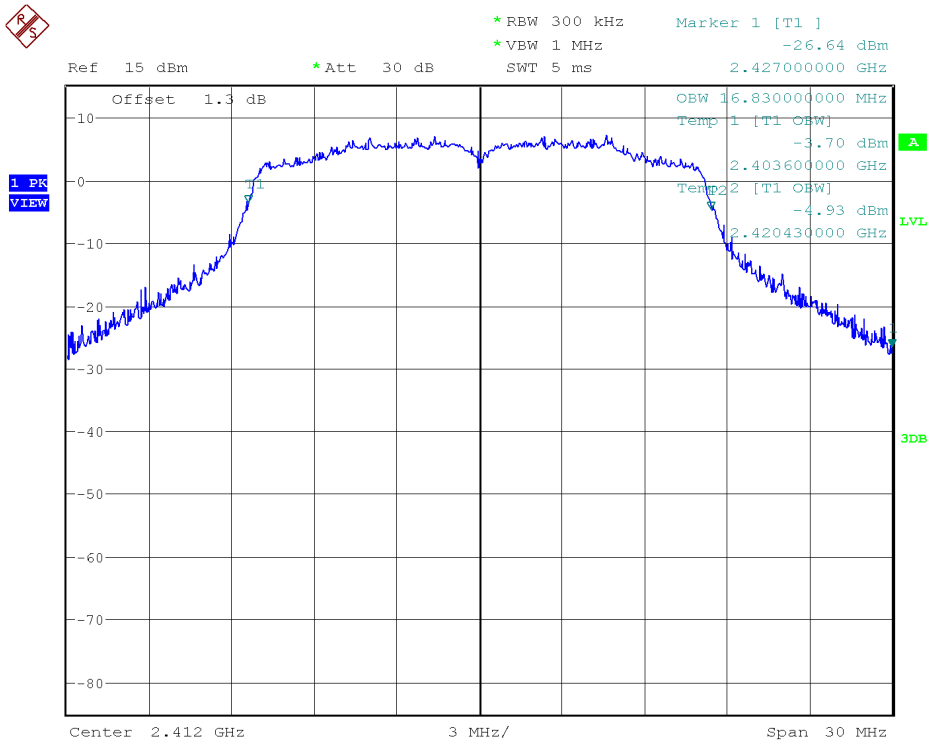


2. WiFi 2.4GHz 802.11 g mode

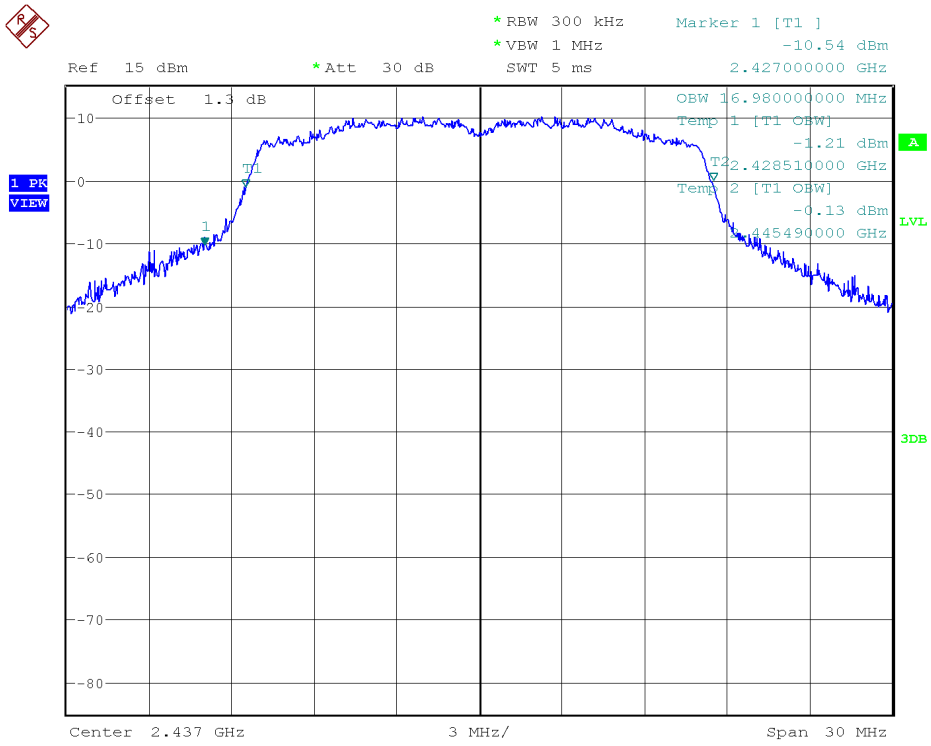
Lowest Channel: 2412 MHz. Chain A



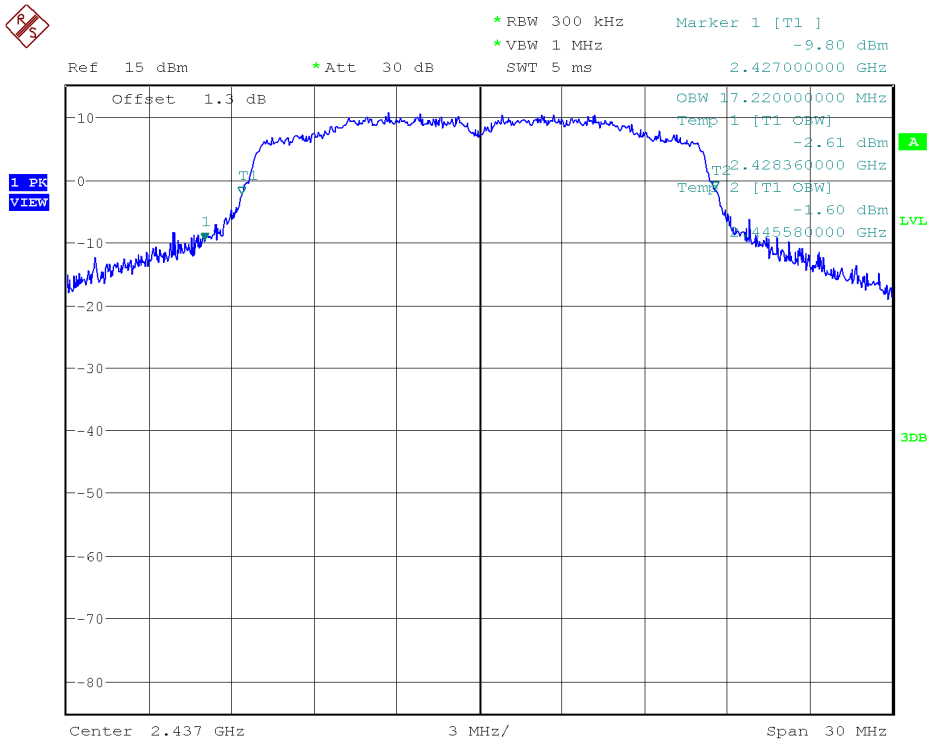
Lowest Channel: 2412 MHz. Chain B



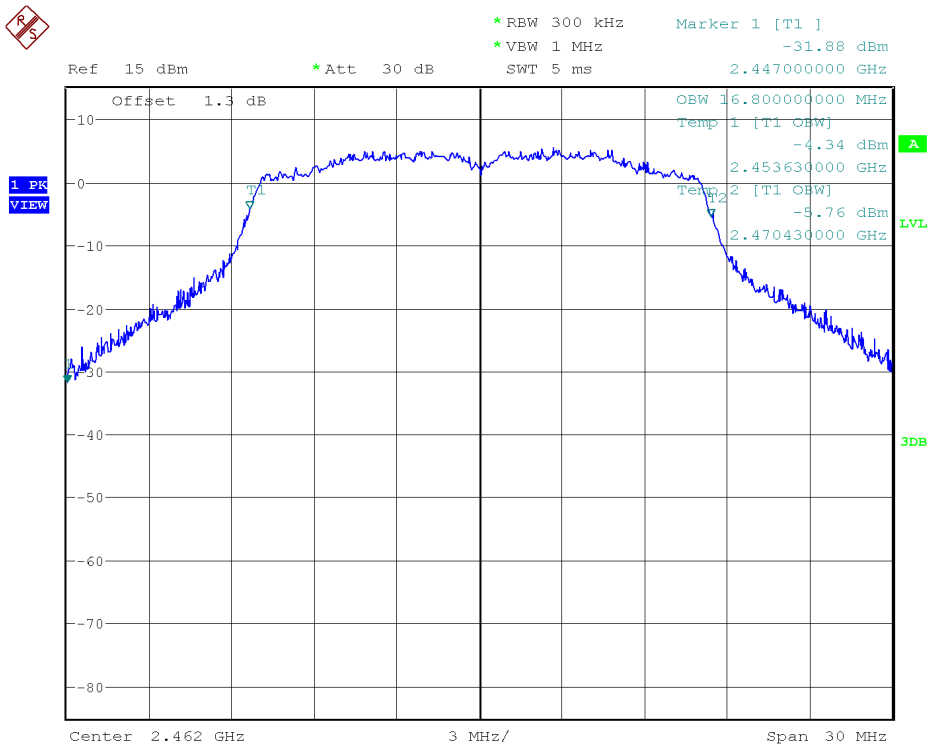
Middle Channel: 2437 MHz. Chain A



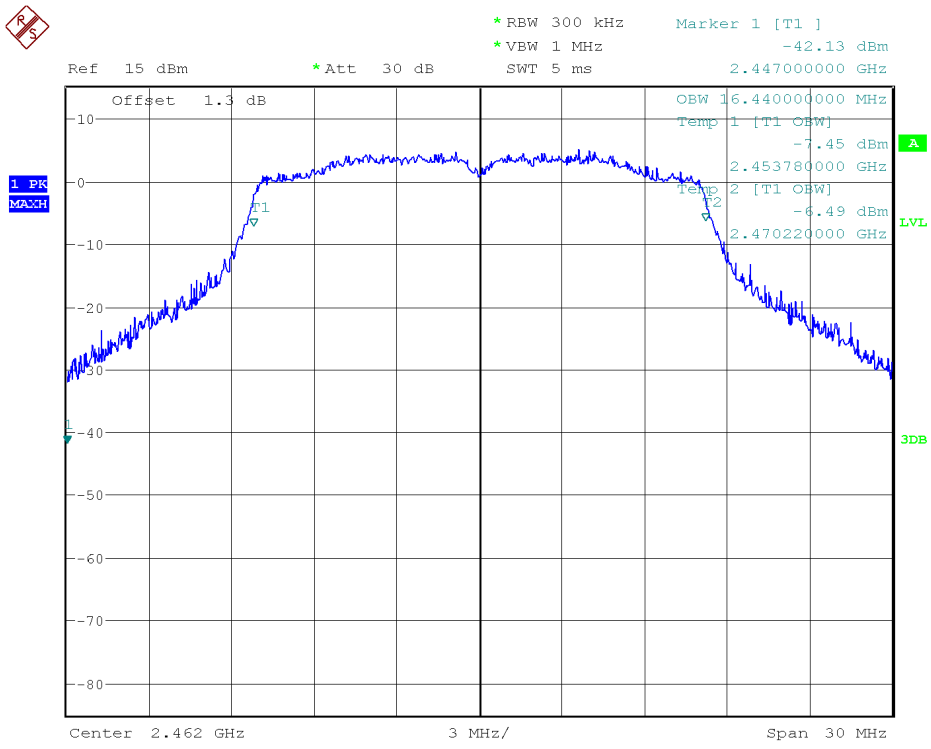
Middle Channel: 2437 MHz. Chain B



Highest Channel: 2462 MHz. Chain A.

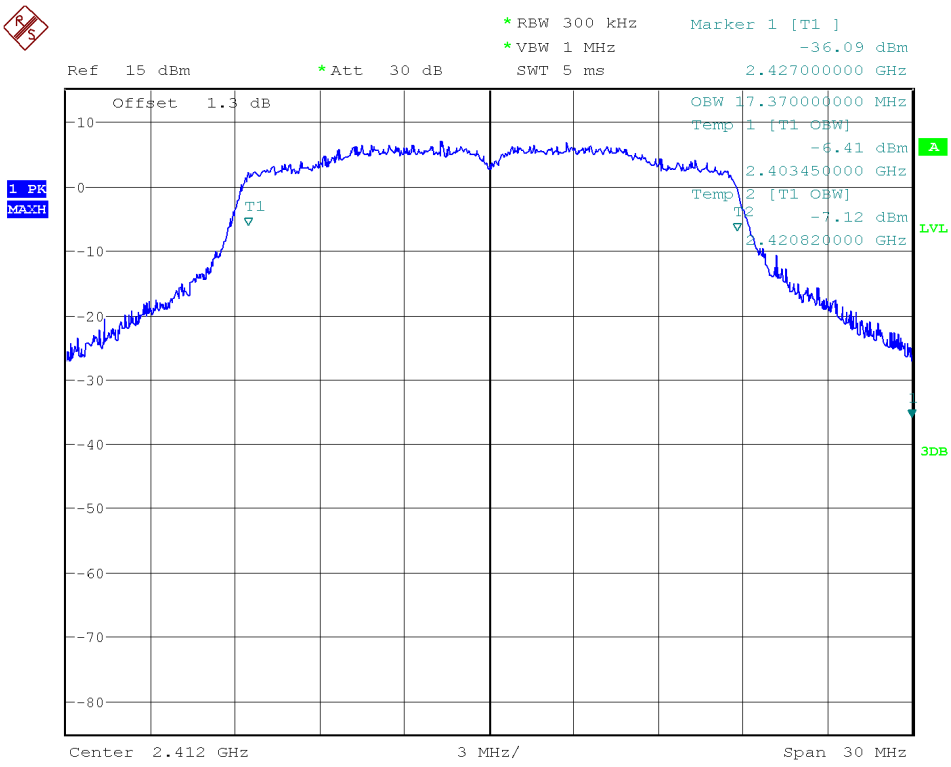


Highest Channel: 2462 MHz. Chain B.

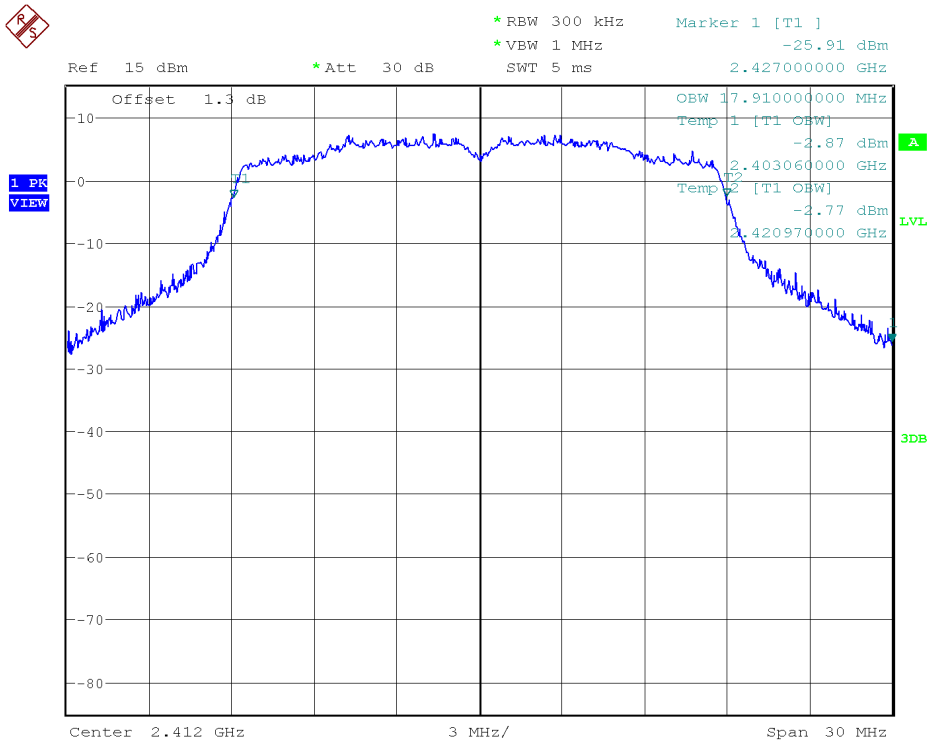


3. WiFi 2.4GHz 802.11 n20 mode

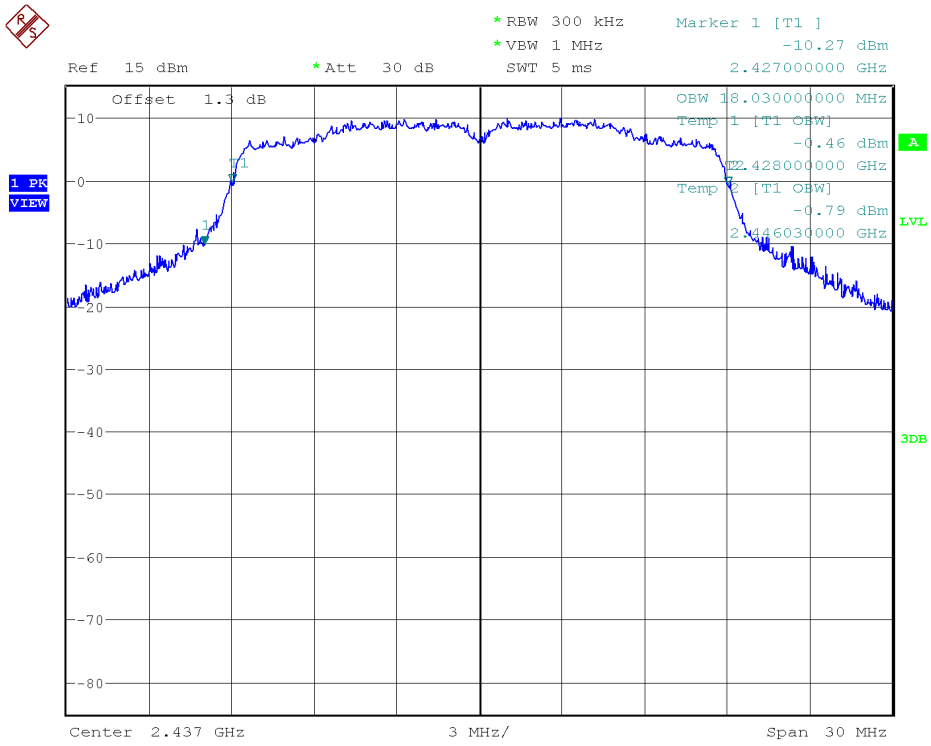
Lowest Channel: 2412 MHz. Chain A



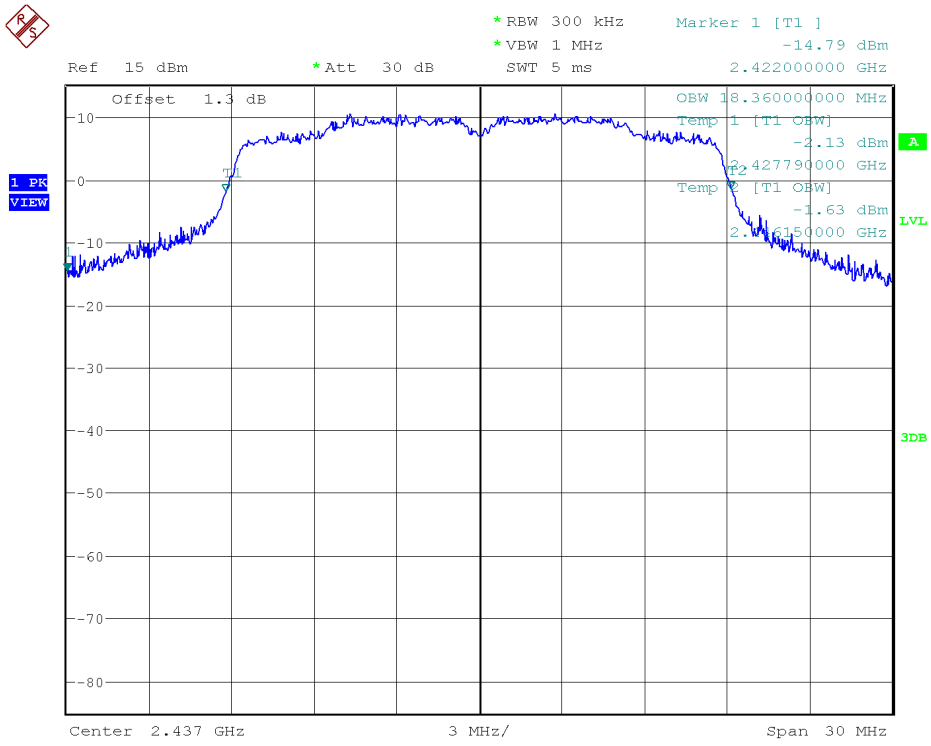
Lowest Channel: 2412 MHz. Chain B



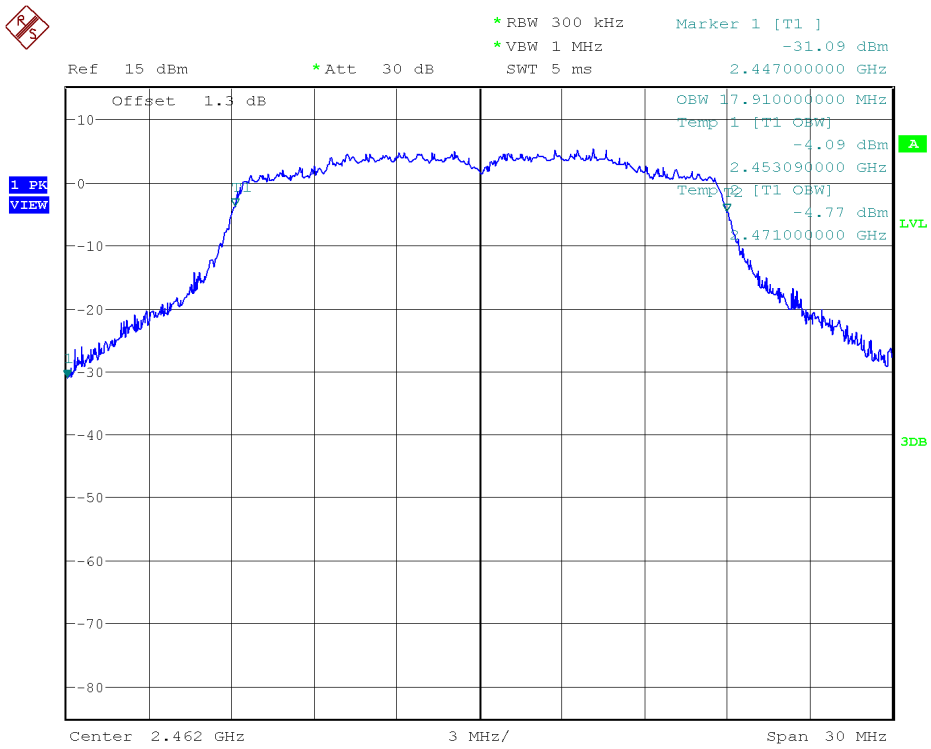
Middle Channel: 2437 MHz. Chain A



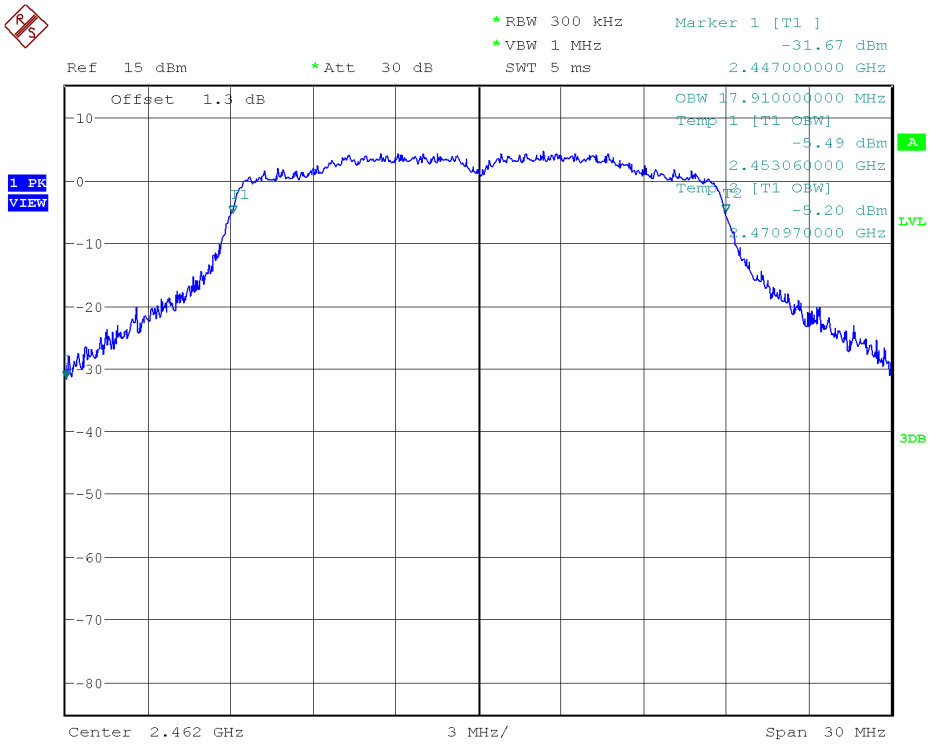
Middle Channel: 2437 MHz. Chain B



Highest Channel: 2462 MHz. Chain A.

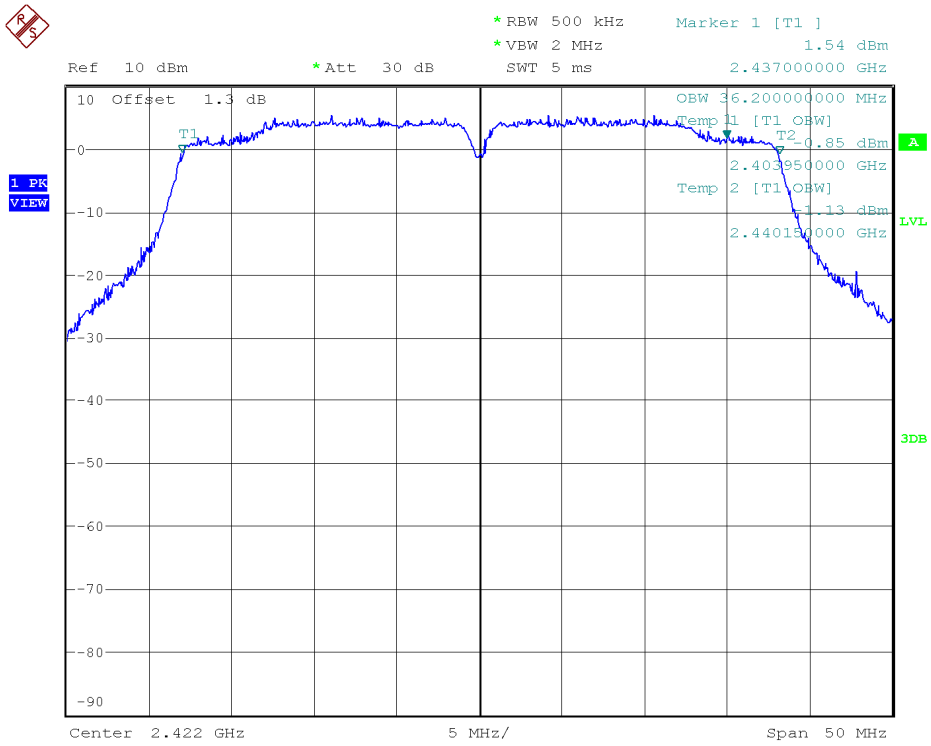


Highest Channel: 2462 MHz. Chain B.

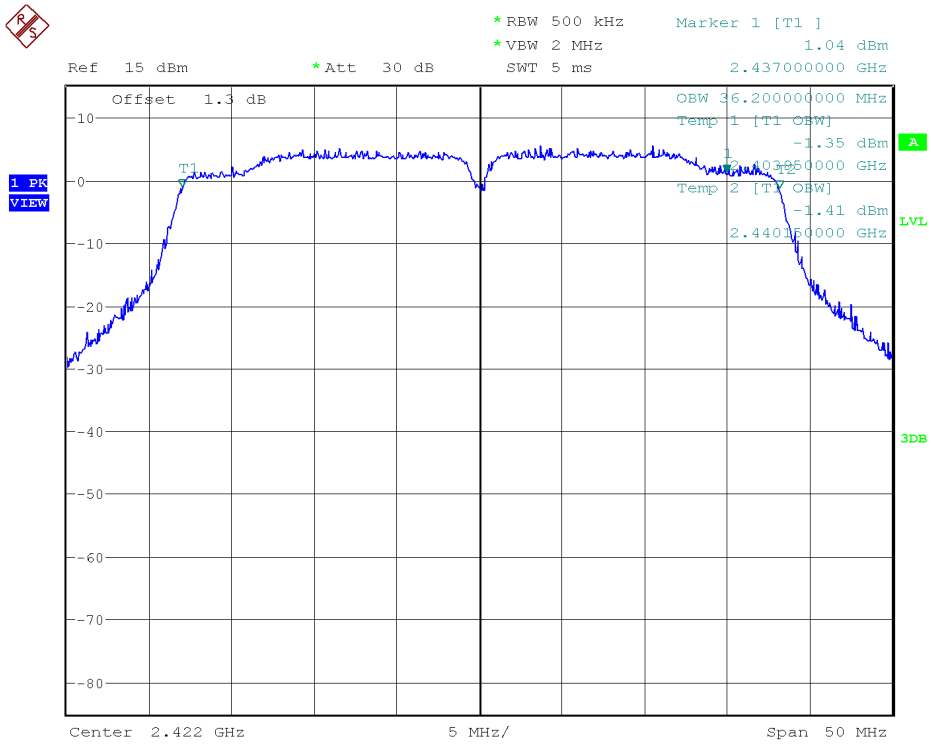


4. WiFi 2.4GHz 802.11 n40 mode

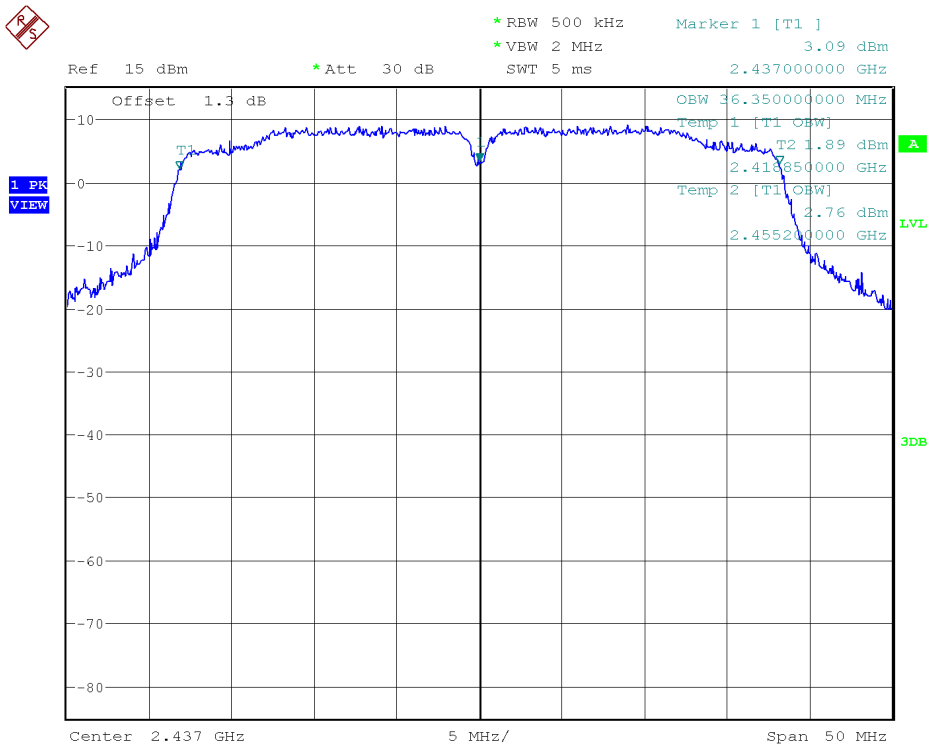
Lowest Channel: 2422 MHz. Chain A



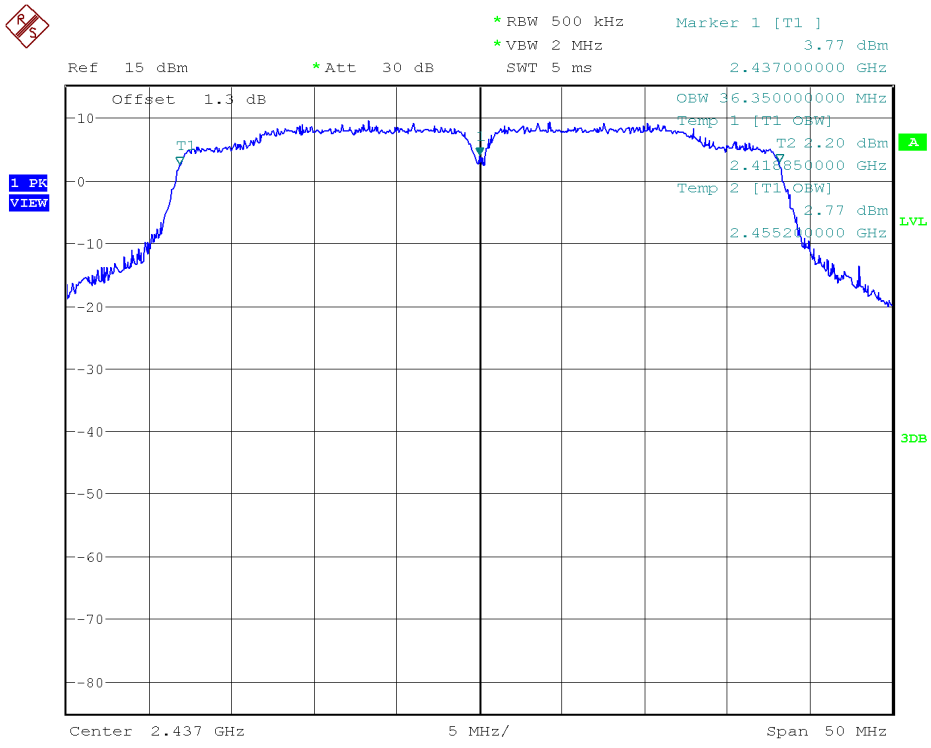
Lowest Channel: 2422 MHz. Chain B



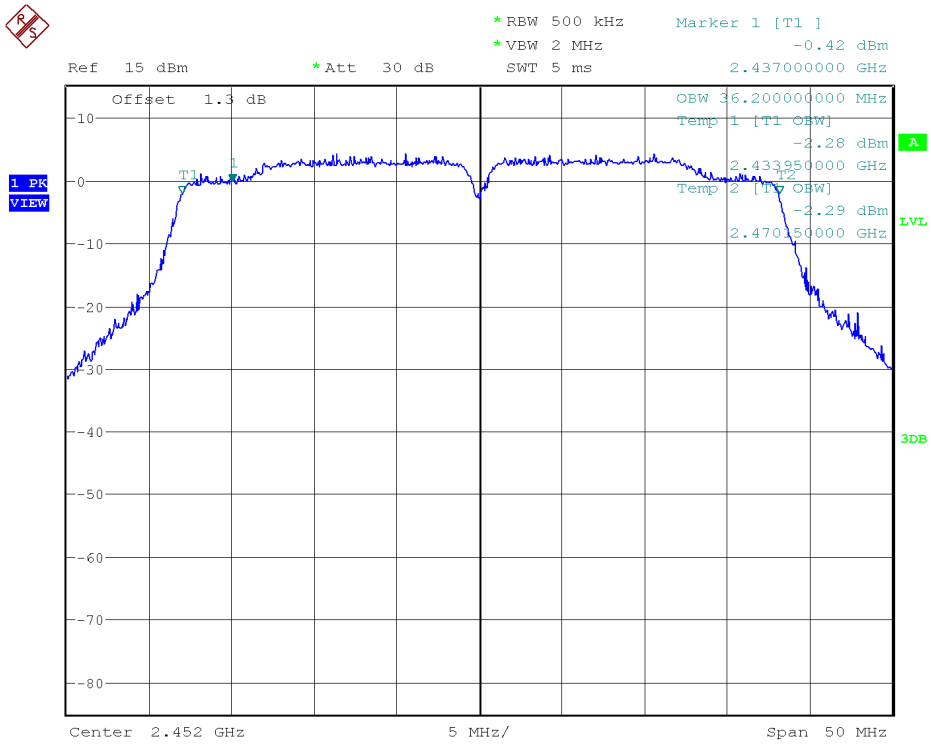
Middle Channel: 2437 MHz. Chain A



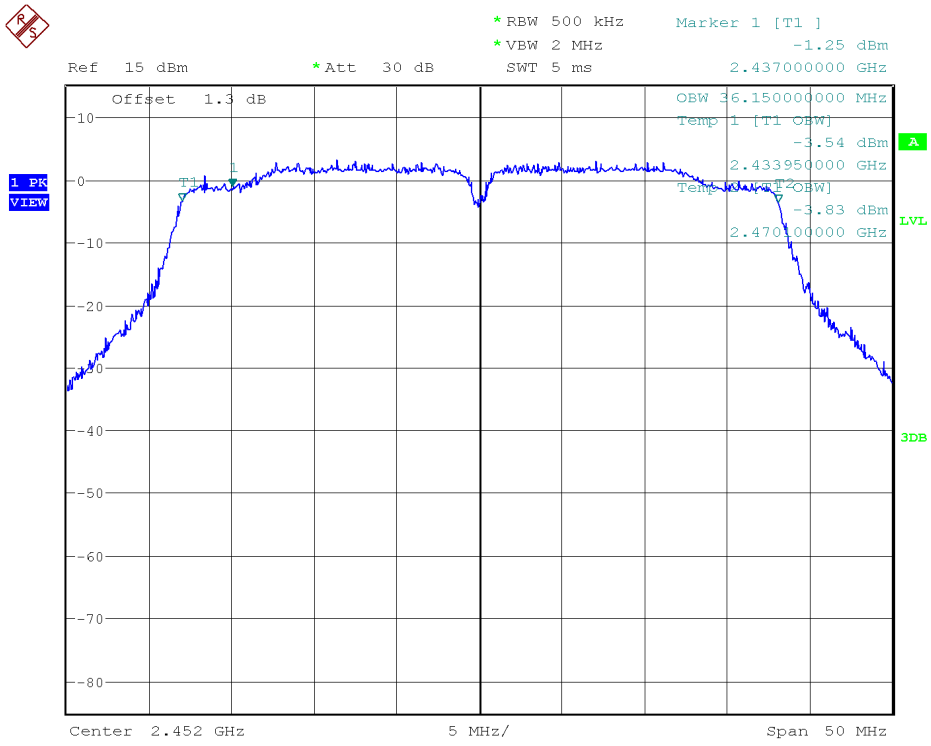
Middle Channel: 2437 MHz. Chain B



Highest Channel: 2452 MHz. Chain A.



Highest Channel: 2452 MHz. Chain B.



SPECIFICATION

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

RESULTS

1. WiFi 2.4GHz 802.11 b mode

6 dB Bandwidth (see next plots).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
6 dB Spectrum bandwidth (MHz)	10.06	10.02	10.03	10.05	10.05	10.03
Measurement uncertainty (kHz)	±89					

Verdict: PASS

2. WiFi 2.4GHz 802.11 g mode

6 dB Bandwidth (see next plots).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
6 dB Spectrum bandwidth (MHz)	16.06	15.53	15.13	15.13	15.29	15.76
Measurement uncertainty (kHz)	±89					

Verdict: PASS

3. WiFi 2.4GHz 802.11 n20 mode

6 dB Bandwidth (see next plots).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
6 dB Spectrum bandwidth (MHz)	15.92	15.16	15.46	15.06	15.96	15.27
Measurement uncertainty (kHz)	±89					

Verdict: PASS

4. WiFi 2.4GHz 802.11 n40 mode

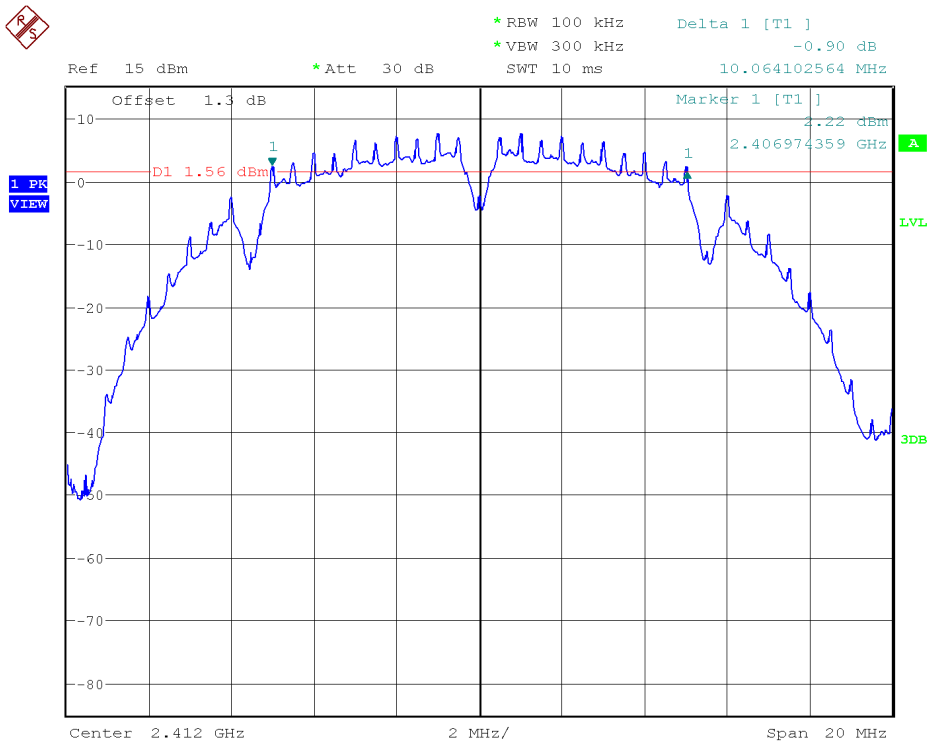
6 dB Bandwidth (see next plots).

	Lowest frequency 2422 MHz		Middle frequency 2437 MHz		Highest frequency 2452 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
6 dB Spectrum bandwidth (MHz)	35.13	35.13	35.13	35.13	35.13	35.13
Measurement uncertainty (kHz)	±89					

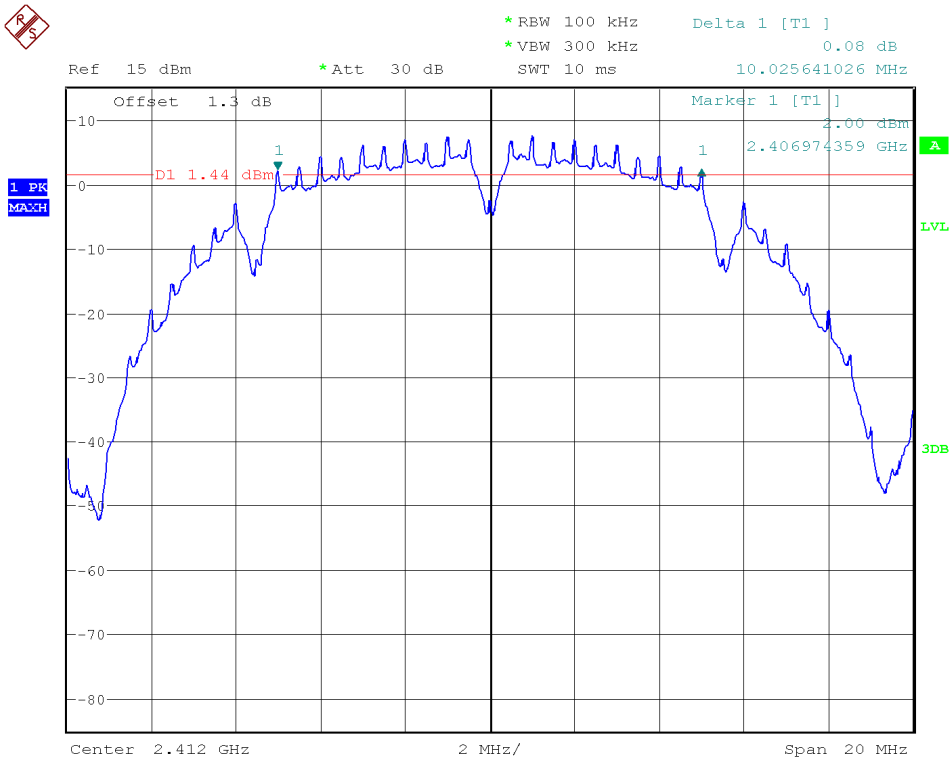
Verdict: PASS

1. WiFi 2.4GHz 802.11 b mode

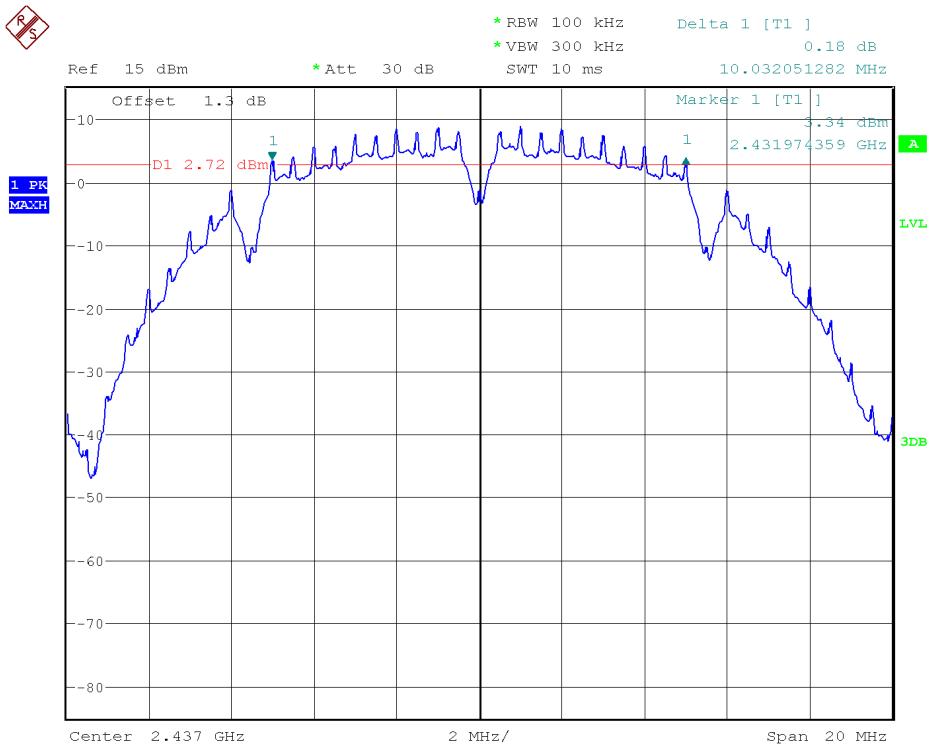
Lowest Channel: 2412 MHz. Chain A.



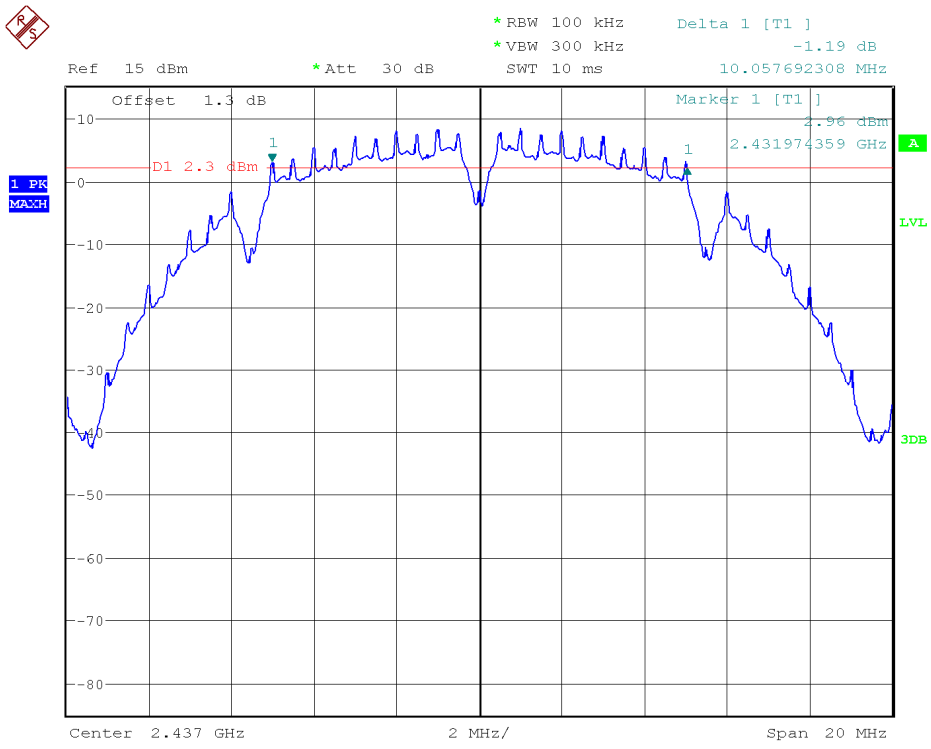
Lowest Channel: 2412 MHz. Chain B.



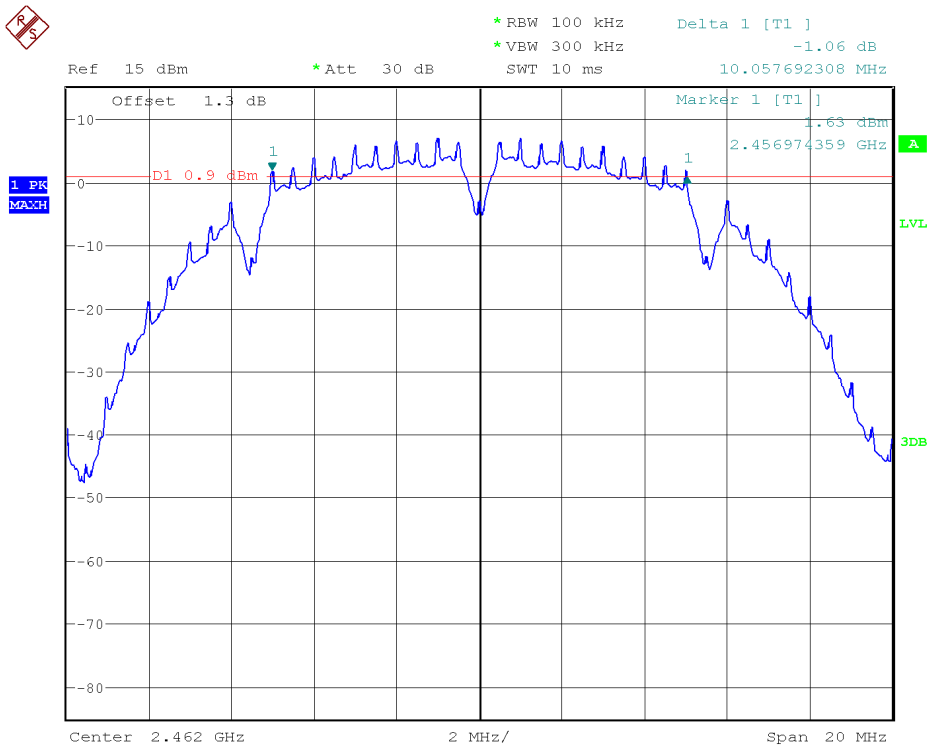
Middle Channel: 2437 MHz. Chain A



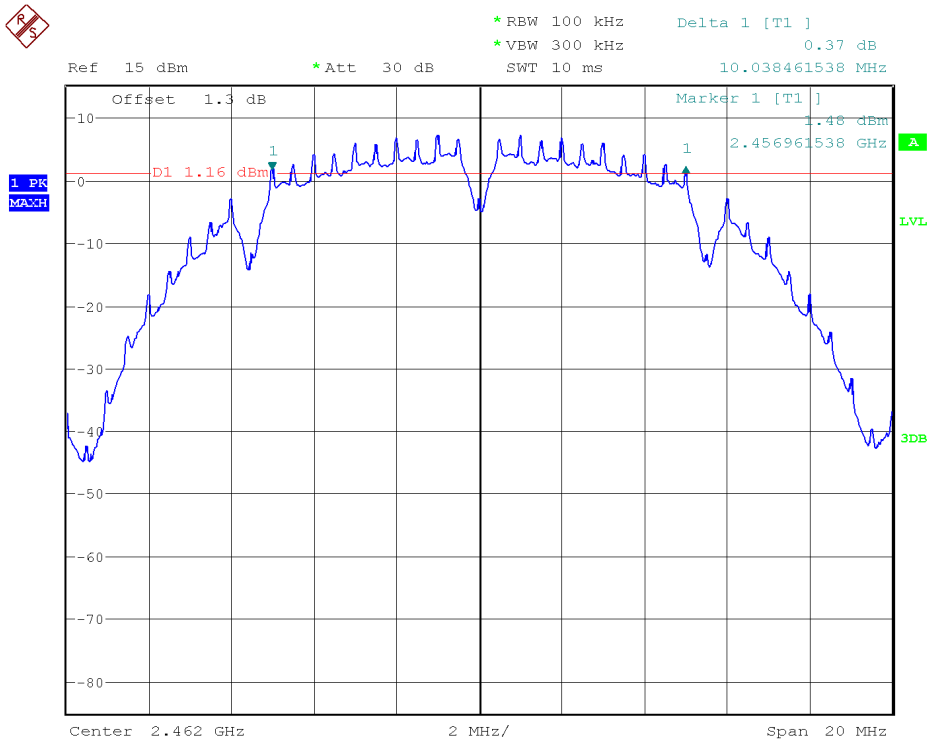
Middle Channel: 2437 MHz. Chain B.



Highest Channel: 2462 MHz. Chain A.

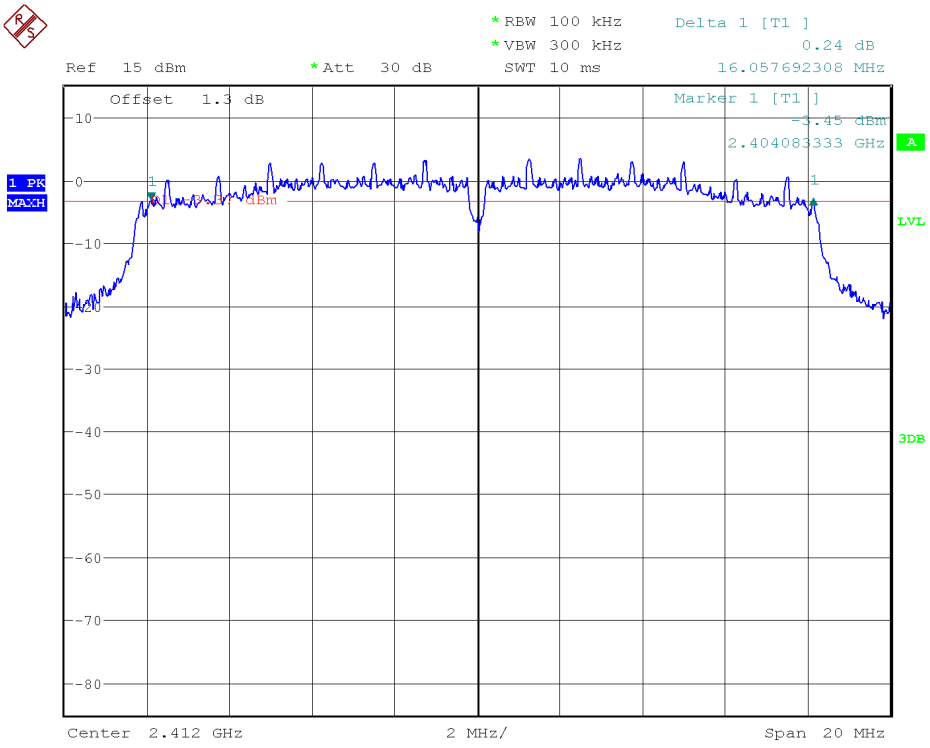


Highest Channel: 2462 MHz. Chain B.

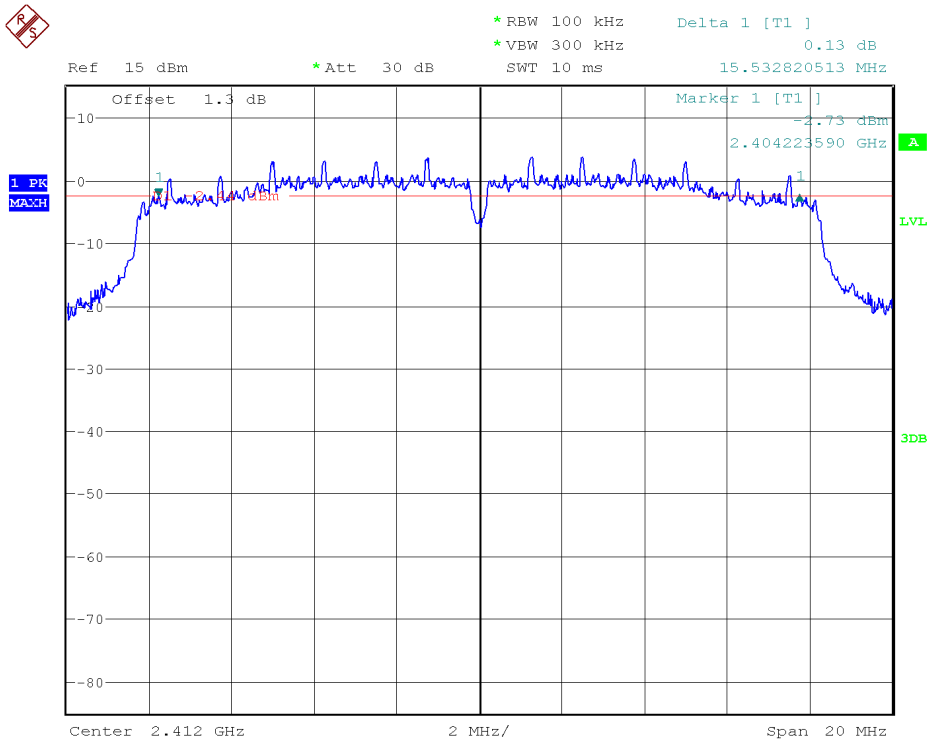


2. WiFi 2.4GHz 802.11 g mode

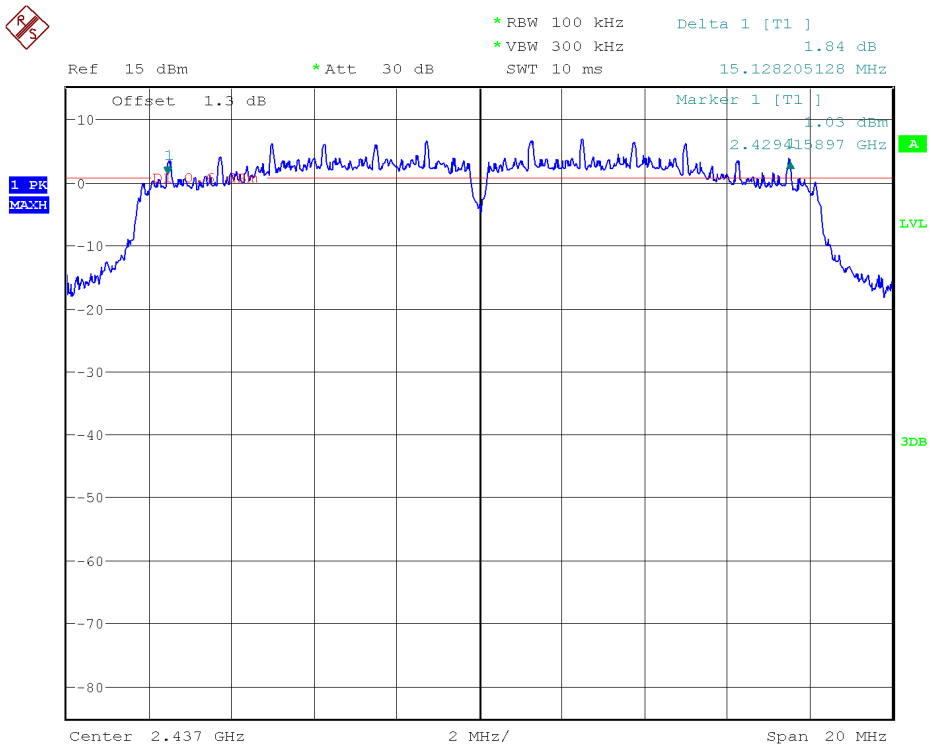
Lowest Channel: 2412 MHz. Chain A



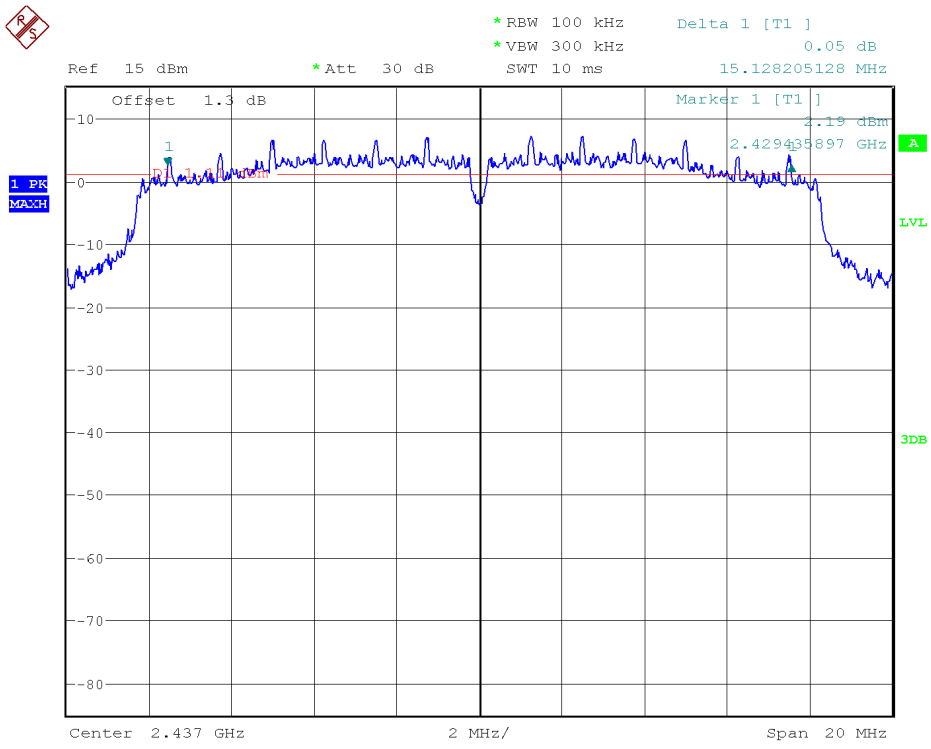
Lowest Channel: 2412 MHz. Chain B



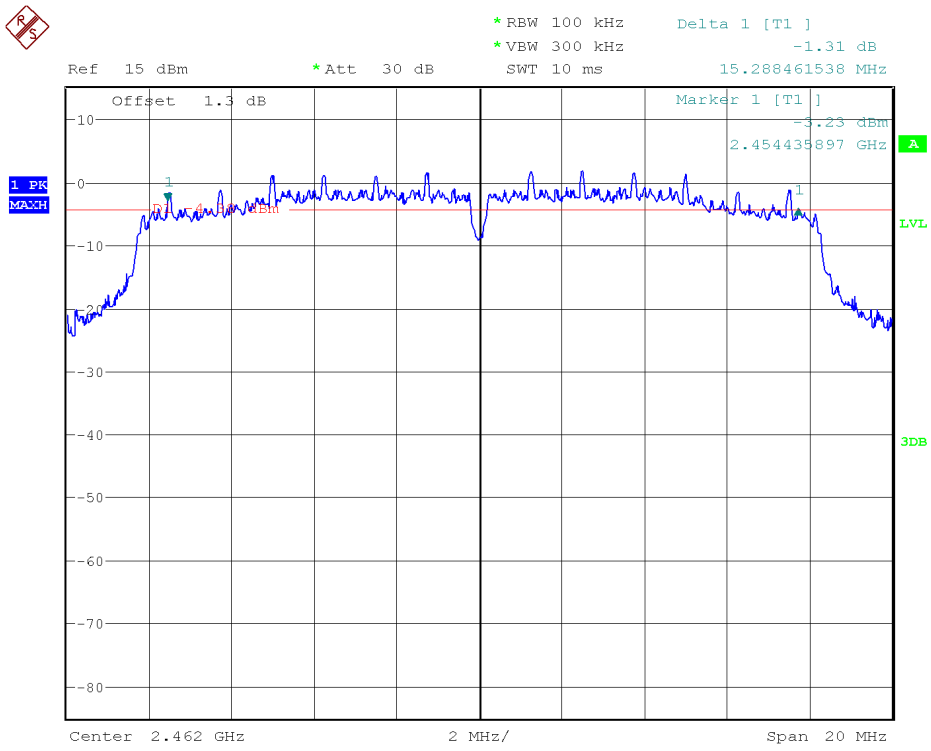
Middle Channel: 2437 MHz. Chain A



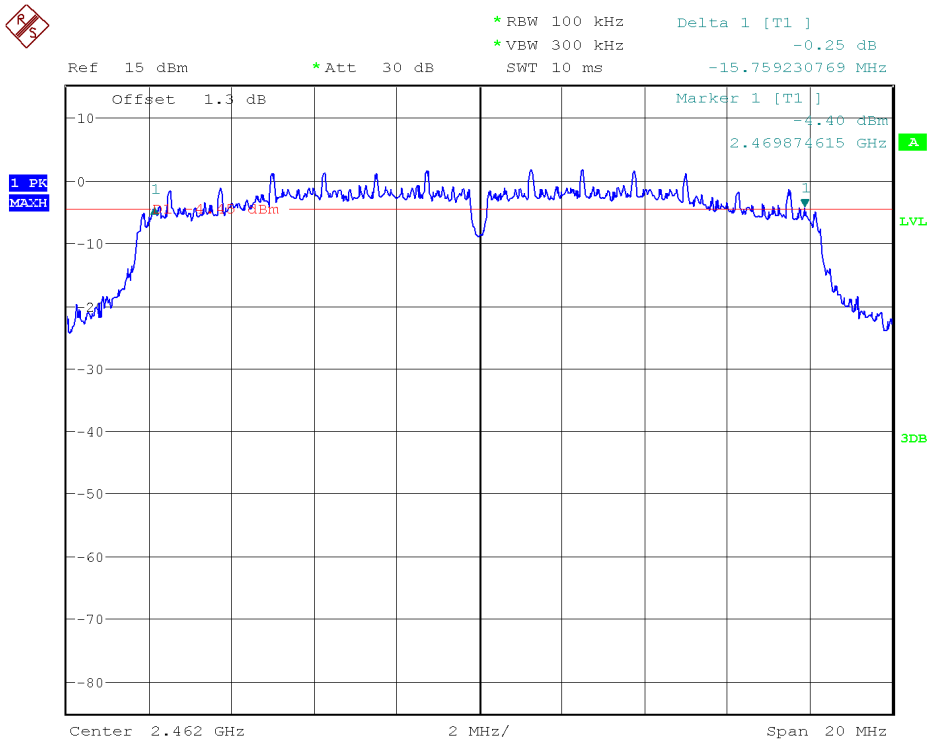
Middle Channel: 2437 MHz. Chain B



Highest Channel: 2462 MHz. Chain A

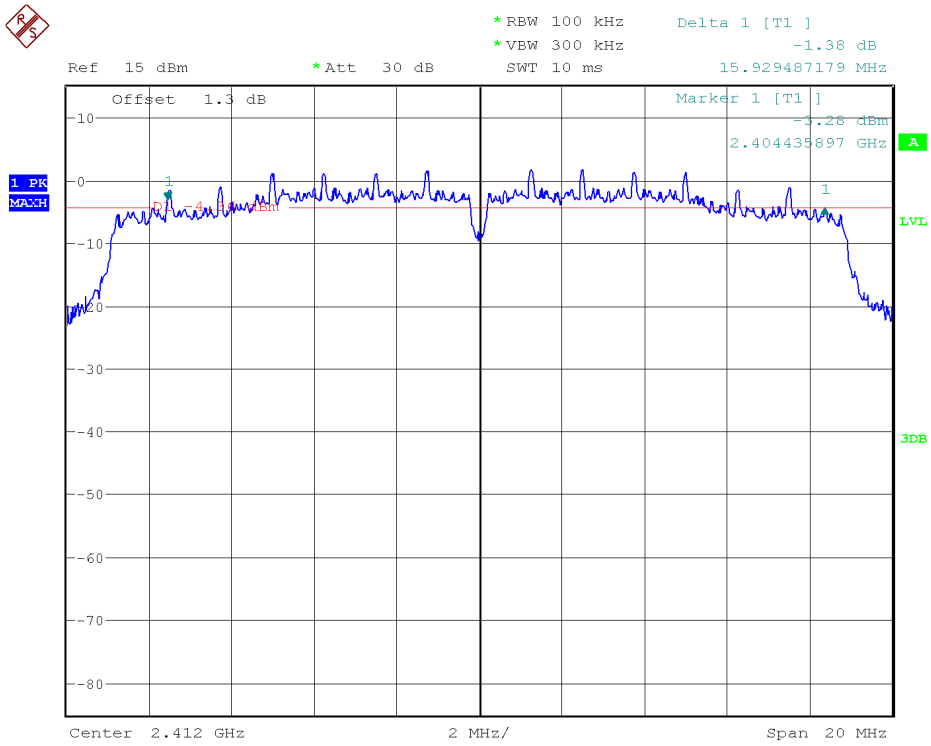


Highest Channel: 2462 MHz. Chain B

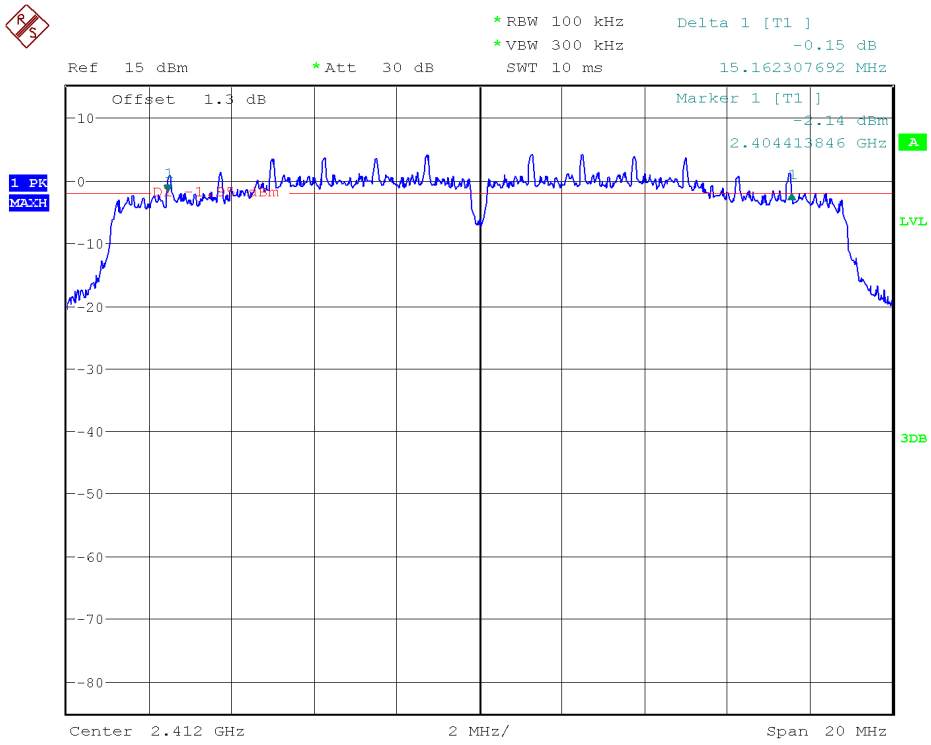


3. WiFi 2.4GHz 802.11 n20 mode

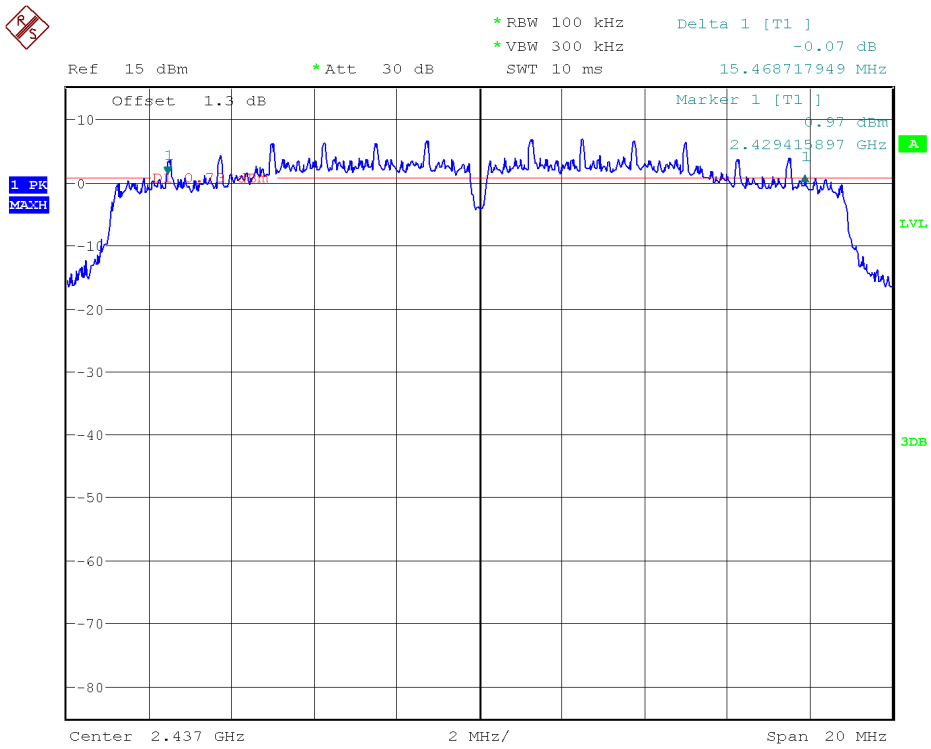
Lowest Channel: 2412 MHz. Chain A



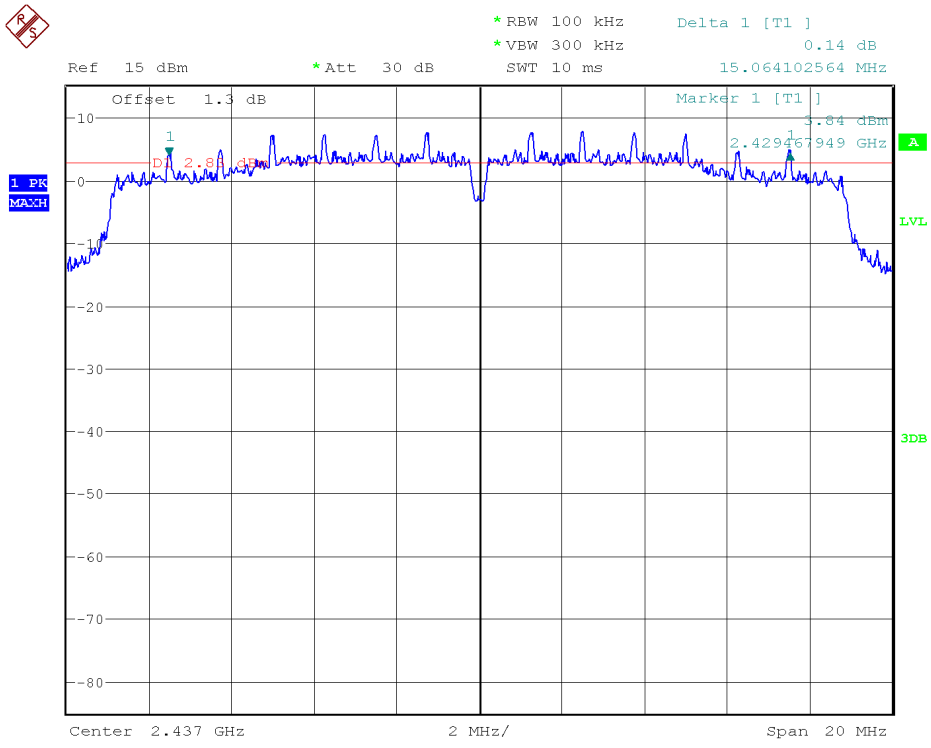
Lowest Channel: 2412 MHz. Chain B



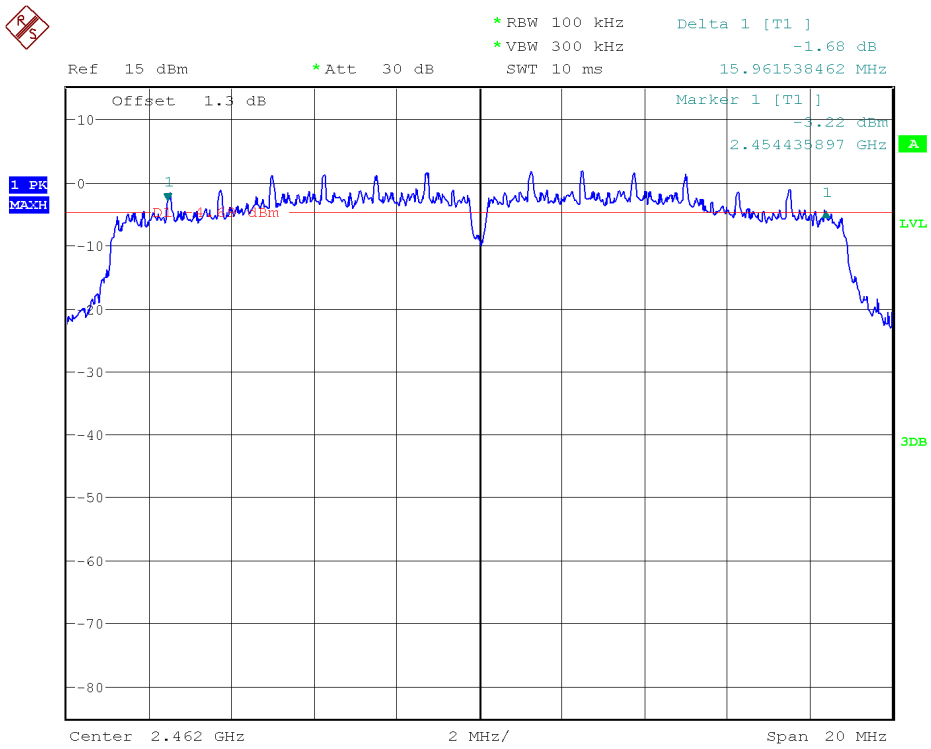
Middle Channel: 2437 MHz. Chain A



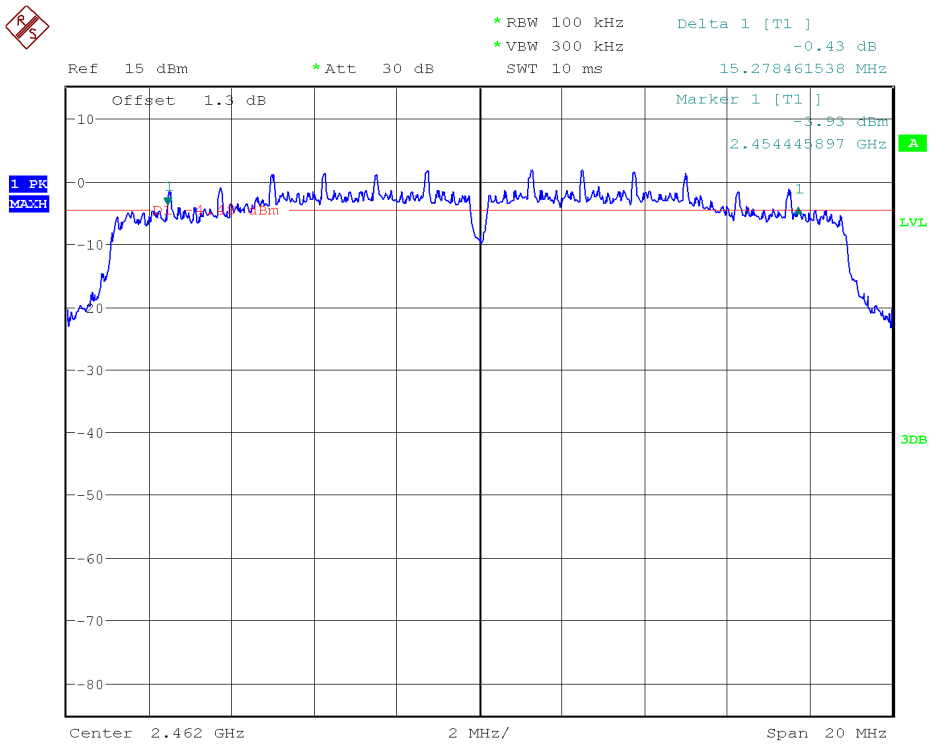
Middle Channel: 2437 MHz. Chain B



Highest Channel: 2462 MHz. Chain A

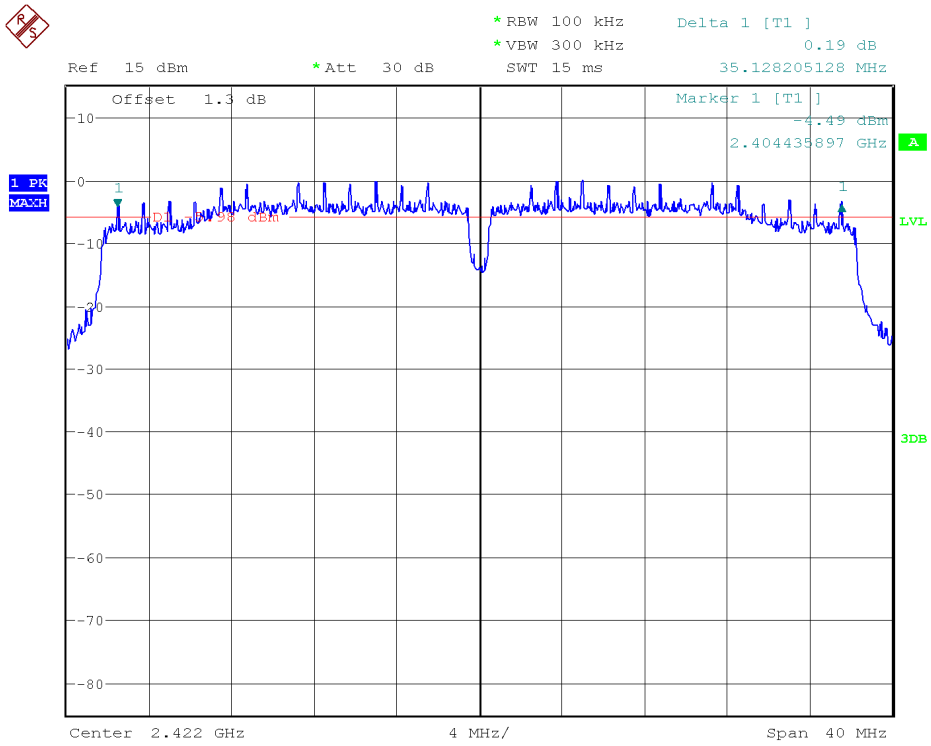


Highest Channel: 2462 MHz. Chain B

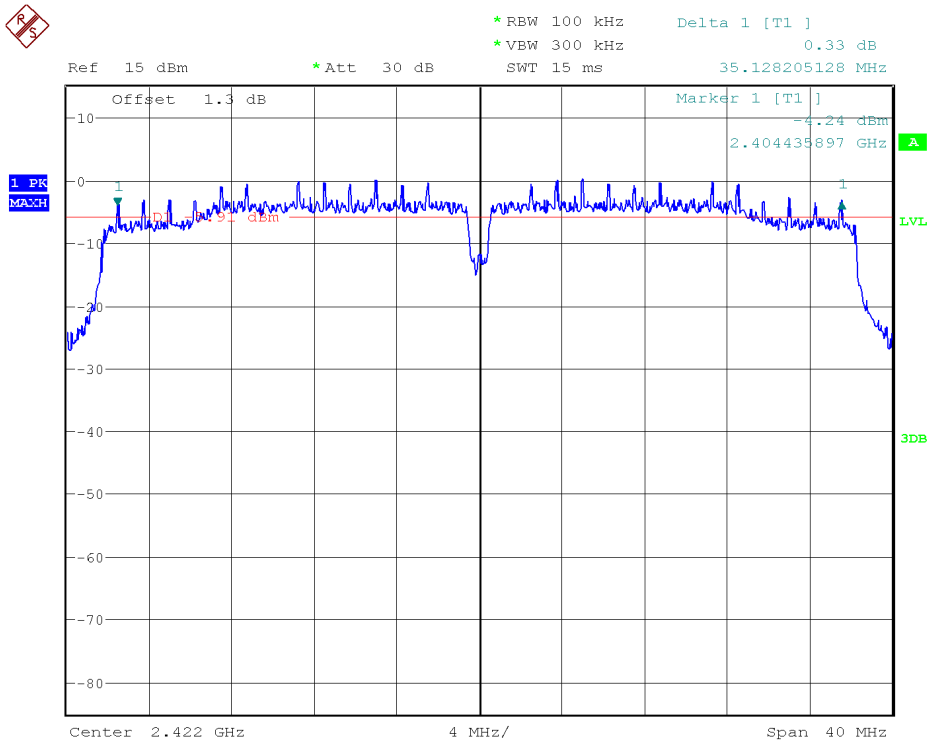


4. WiFi 2.4GHz 802.11 n40 mode

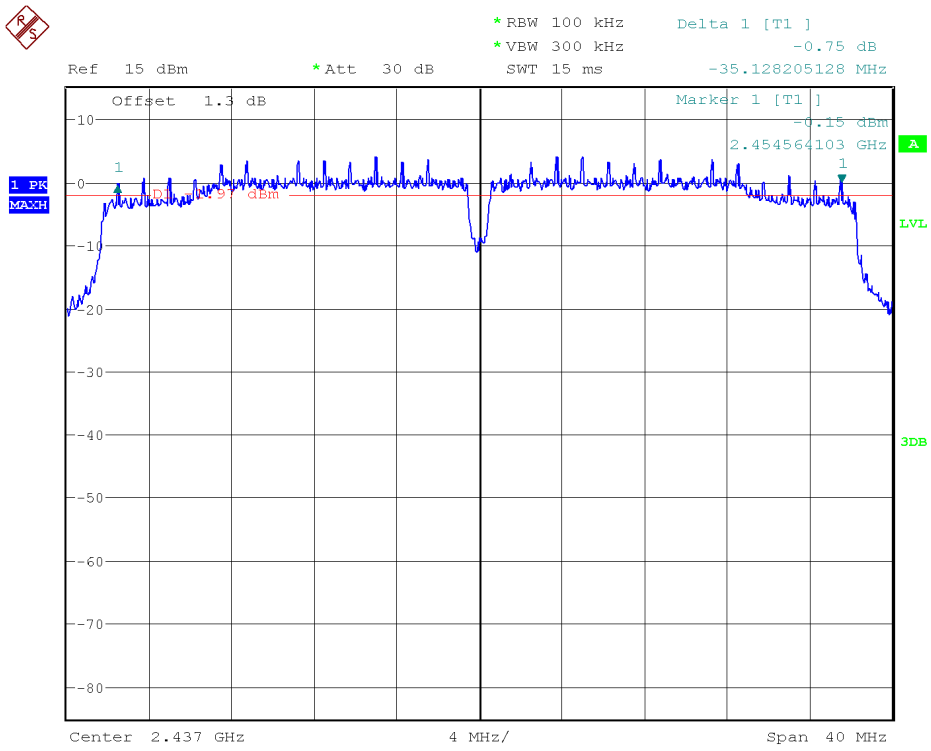
Lowest Channel: 2422 MHz. Chain A



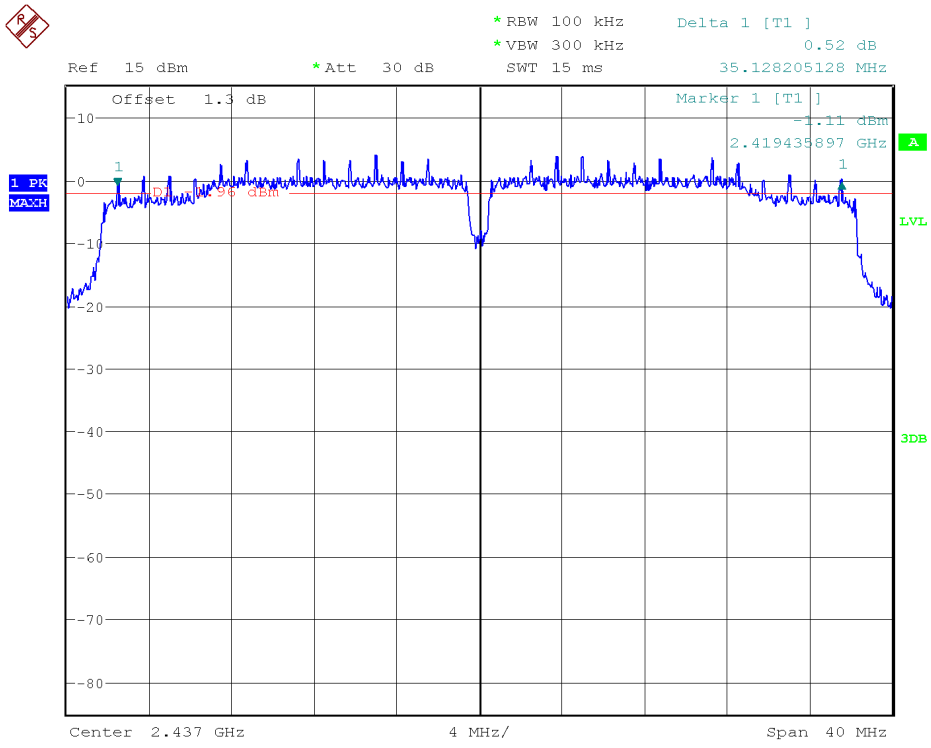
Lowest Channel: 2422 MHz. Chain B



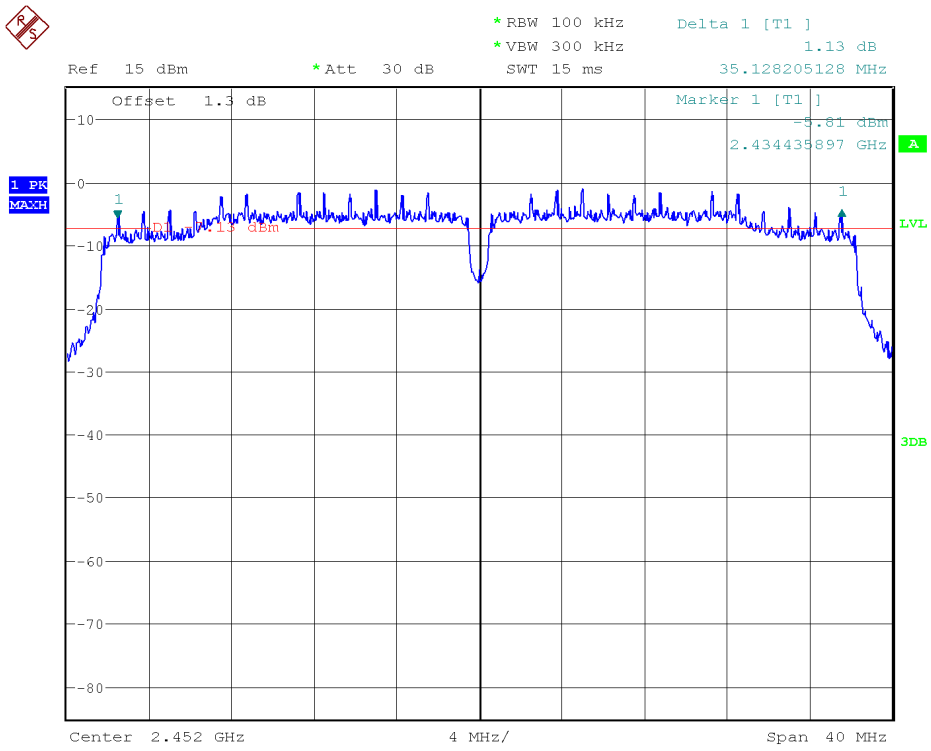
Middle Channel: 2437 MHz. Chain A



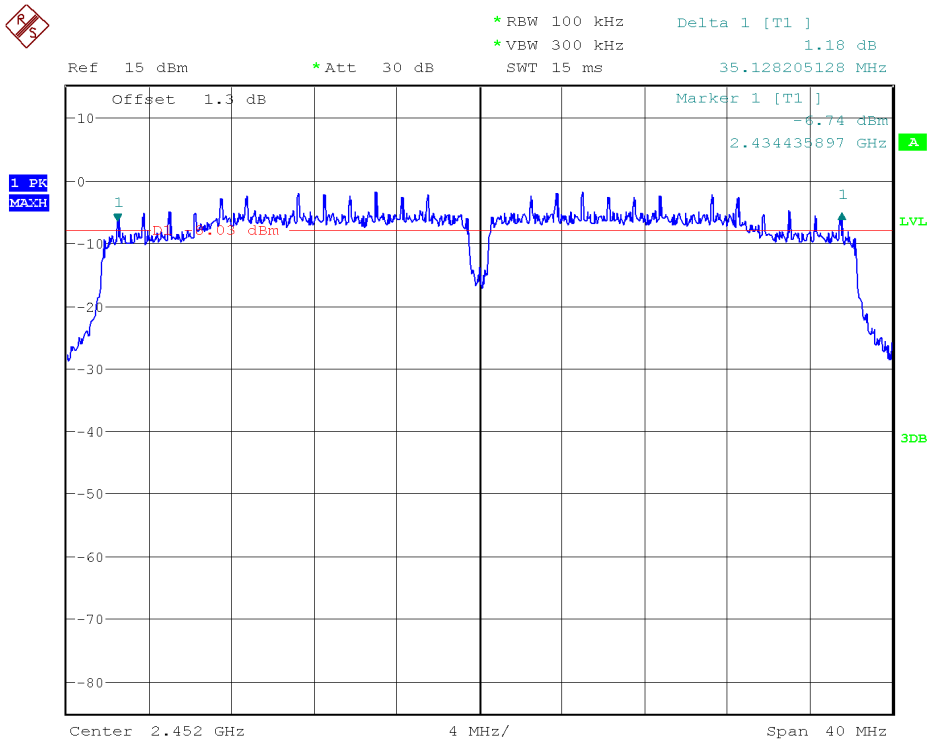
Middle Channel: 2437 MHz. Chain B



Highest Channel: 2452 MHz. Chain A



Highest Channel: 2452 MHz. Chain B



Section 15.247 Subclause (b) / RSS-210 A8.4. (4). Maximum output power and antenna gain

SPECIFICATION

The maximum peak conducted output power of the intentional radiator shall not exceed 1 watt (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS

The maximum Peak Conducted Output Power was measured using the channel integration method according to point 9.1.2. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03r01 dated 09/04/2013. This method was used for 802.11g and 802.11n20 modes.

The maximum conducted (average) output power was measured using the method according to point 9.2.1.2. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03r01 dated 09/04/2013. This method was used for 802.11b and 802.11n40 modes.

In the measure-and-sum approach for MIMO mode, the conducted emission level (*e.g.*, transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units (mW—not dBm).

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

For MIMO mode, the Guidance on directional Gain calculations according to the Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01 dated 10/31/2013 was used.
The number of transmit antennas (N_{ANT}) are 2 and the number of spatial streams (Nss) are 2 and therefore the Array Gain is 0 dB.

1. WiFi 2.4GHz 802.11 b mode

MAXIMUM OUTPUT POWER. Conducted (average) output power (See next plot of worst case: Highest power levels).

Maximum declared antenna gain: 3.24 dBi.

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Maximum conducted power (dBm)	16.12	16.33	17.21	17.31	16.55	16.20
Maximum EIRP power (dBm)	19.36	19.57	20.45	20.55	19.79	19.44
Measurement uncertainty (dB)	±1.5					

Verdict: PASS

2. WiFi 2.4GHz 802.11 g mode

MAXIMUM OUTPUT POWER. Peak Conducted Output Power (See next plot of worst case: Highest power level).

Maximum declared antenna gain: 3.24 dBi.

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Maximum conducted power (dBm)	16.86	17.04	20.18	20.49	15.29	14.89
Maximum EIRP power (dBm)	20.10	20.28	23.42	23.73	18.53	18.13
Measurement uncertainty (dB)	±1.5					

Verdict: PASS

Conducted (average) output power. These results are for information purposes only.

Maximum declared antenna gain: 3.24 dBi.

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Maximum conducted power (dBm)	13.91	14.37	17.19	17.60	12.13	12.64
Maximum EIRP power (dBm)	17.15	17.61	20.43	20.84	15.37	15.88
Measurement uncertainty (dB)	±1.5					

3. WiFi 2.4GHz 802.11 n20 mode

MAXIMUM OUTPUT POWER. Peak Conducted Output Power (See next plot of worst case: Highest power level).

Maximum declared antenna gain: 3.24 dBi.

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Maximum conducted power (dBm)	16.57	17.02	20.00	20.72	15.24	14.87
Maximum EIRP power (dBm)	19.81	20.26	23.24	23.96	18.48	18.11
Measurement uncertainty (dB)	±1.5					

MIMO	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A+B		Chain A+B		Chain A+B	
	Port A	Port B	Port A	Port B	Port A	Port B
Maximum conducted power (dBm)	14.85	14.26	25.57	26.54	14.16	14.57
	Port A+B		Port A+B		Port A+B	
Maximum conducted power (dBm)	17.57		29.09		17.38	
Maximum EIRP power (dBm)	20.81		32.33		20.62	
Measurement uncertainty (dB)	±1.5		±1.2		±1.5	

Verdict: PASS

Conducted (average) output power. These results are for information purposes only.

Maximum declared antenna gain: 3.24 dBi.

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Maximum conducted power (dBm)	13.76	14.65	17.18	17.84	12.15	12.18
Maximum EIRP power (dBm)	17.00	17.89	20.42	21.08	15.39	15.42
Measurement uncertainty (dB)	±1.5					

MIMO	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A+B		Chain A+B		Chain A+B	
	Port A	Port B	Port A	Port B	Port A	Port B
Maximum conducted power (dBm)	11.68	11.98	17.13	17.20	12.07	11.90
	Port A+B		Port A+B		Port A+B	
Maximum conducted power (dBm)	14.84		20.18		14.99	
Maximum EIRP power (dBm)	18.08		23.42		18.23	
Measurement uncertainty (dB)	±1.5		±1.2		±1.5	

4. WiFi 2.4GHz 802.11 n40 mode

MAXIMUM OUTPUT POWER. Conducted (average) output power (See next plot of worst case: Highest power level).
Maximum declared antenna gain: 3.24 dBi.

	Lowest frequency 2422 MHz		Middle frequency 2437 MHz		Highest frequency 2452 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Maximum conducted power (dBm)	13.27	13.54	17.25	17.34	12.29	11.28
Maximum EIRP power (dBm)	16.51	16.78	20.49	20.58	15.53	14.52
Measurement uncertainty (dB)	±1.5					

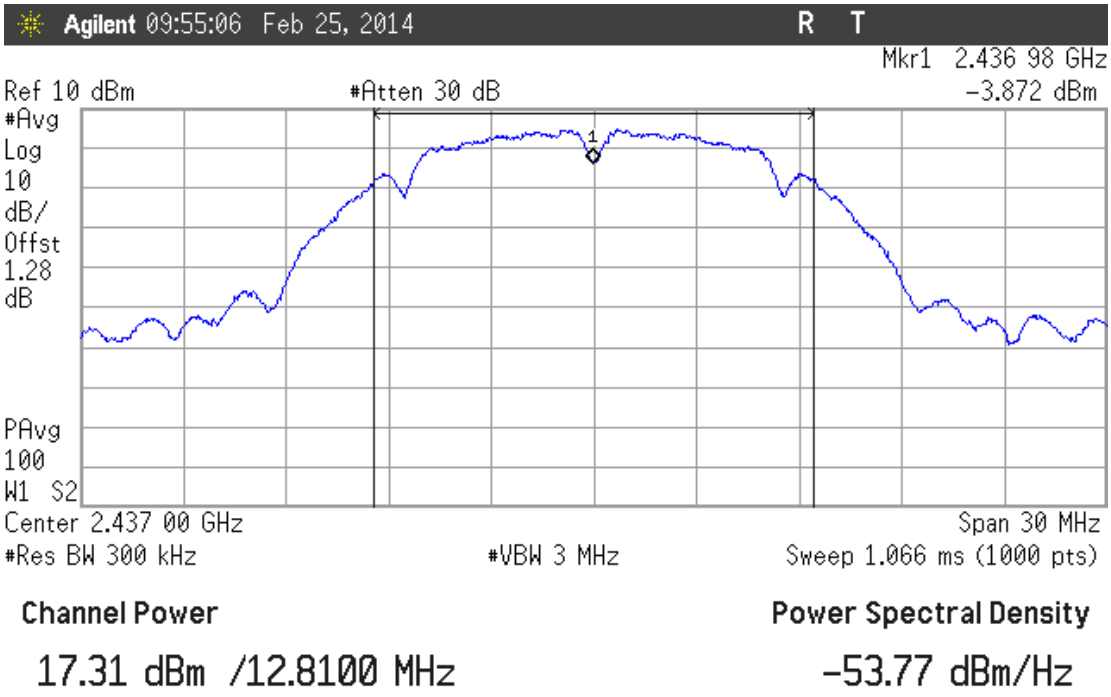
MIMO	Lowest frequency 2422 MHz		Middle frequency 2437 MHz		Highest frequency 2452 MHz	
	Chain A+B		Chain A+B		Chain A+B	
	Port A	Port B	Port A	Port B	Port A	Port B
Maximum conducted power (dBm)	9.54	9.53	13.54	13.45	9.37	9.37
	Port A+B		Port A+B		Port A+B	
Maximum conducted power (dBm)	12.54		16.50		12.38	
Maximum EIRP power (dBm)	15.78		19.74		15.62	
Measurement uncertainty (dB)	±1.5					

Verdict: PASS

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.

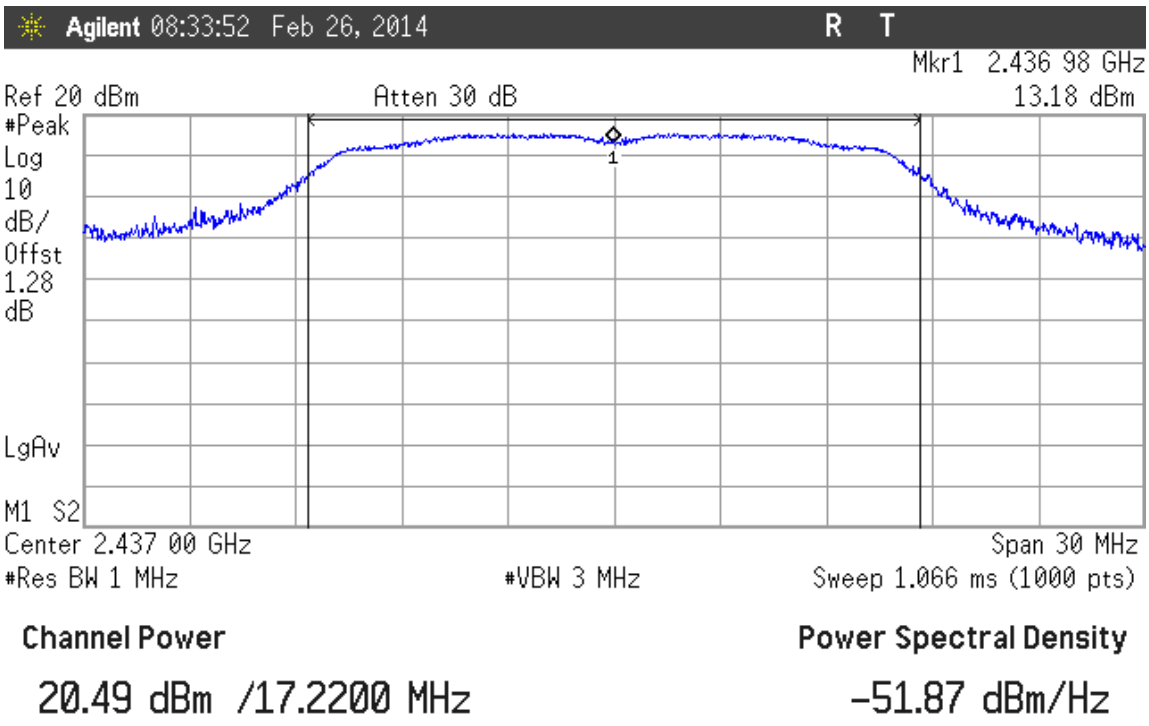
1. WiFi 2.4GHz 802.11 b mode

Middle frequency 2437 MHz. Chain B.



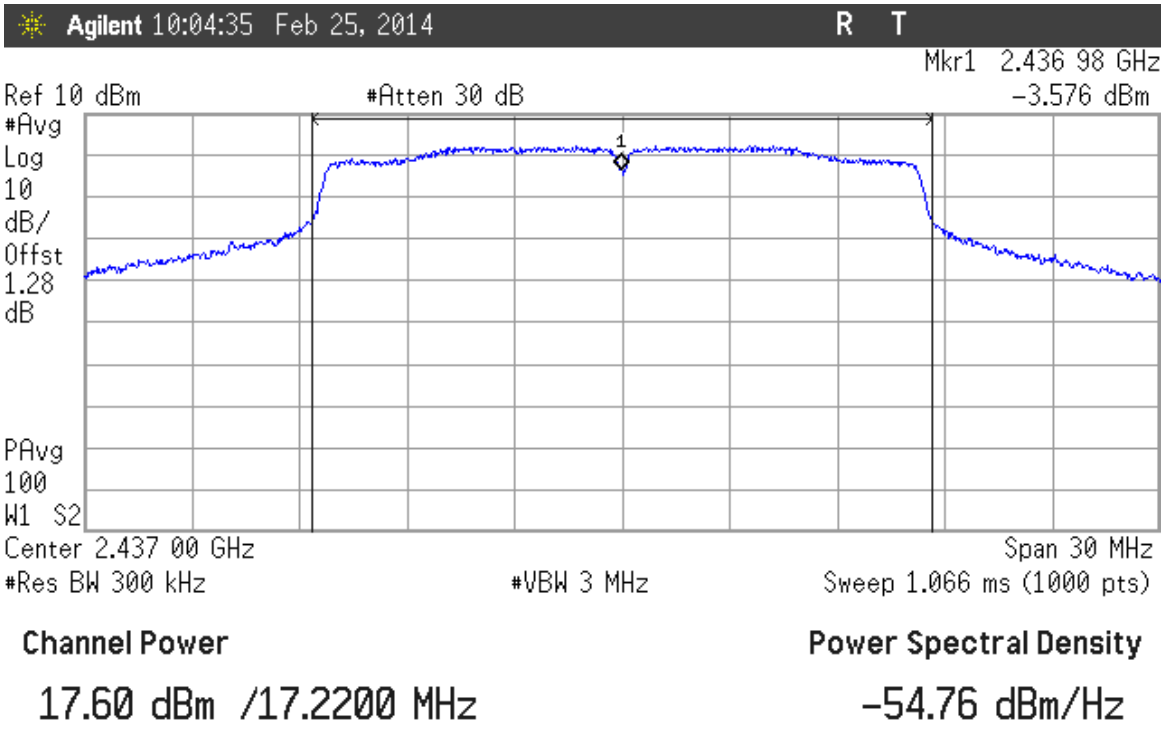
2. WiFi 2.4GHz 802.11 g mode

Peak conducted output power.
Middle frequency 2437 MHz. Chain B.



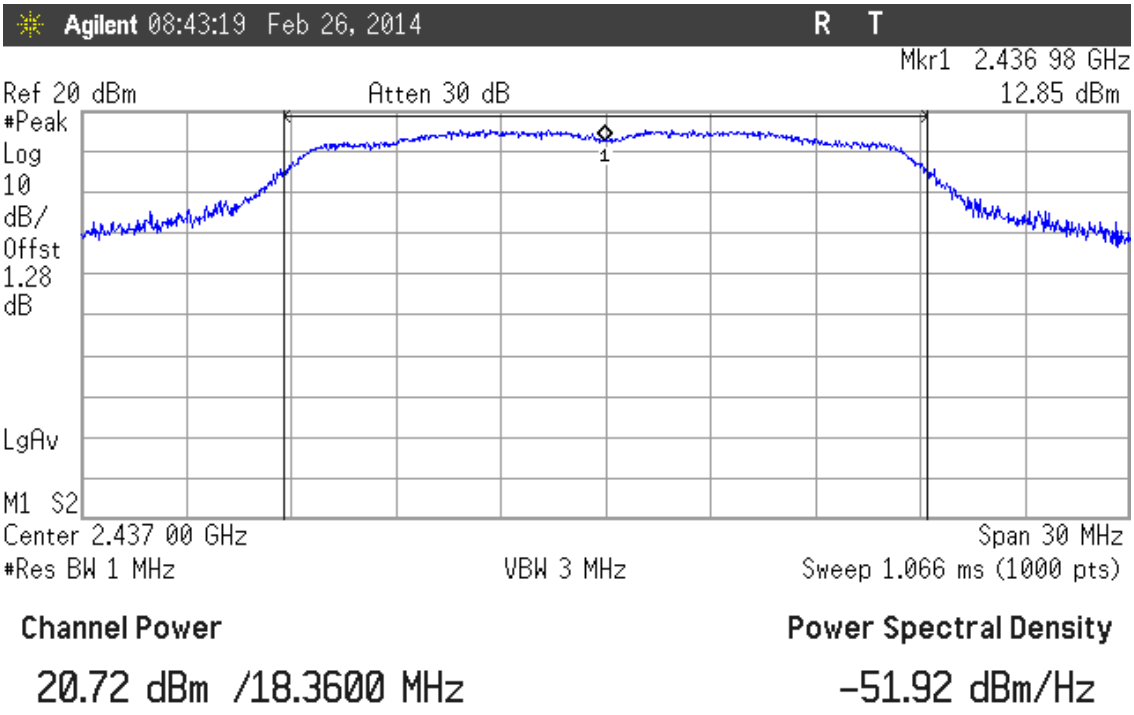
Conducted (average) output power (for information purposes only).

Middle frequency 2437 MHz. Chain B.

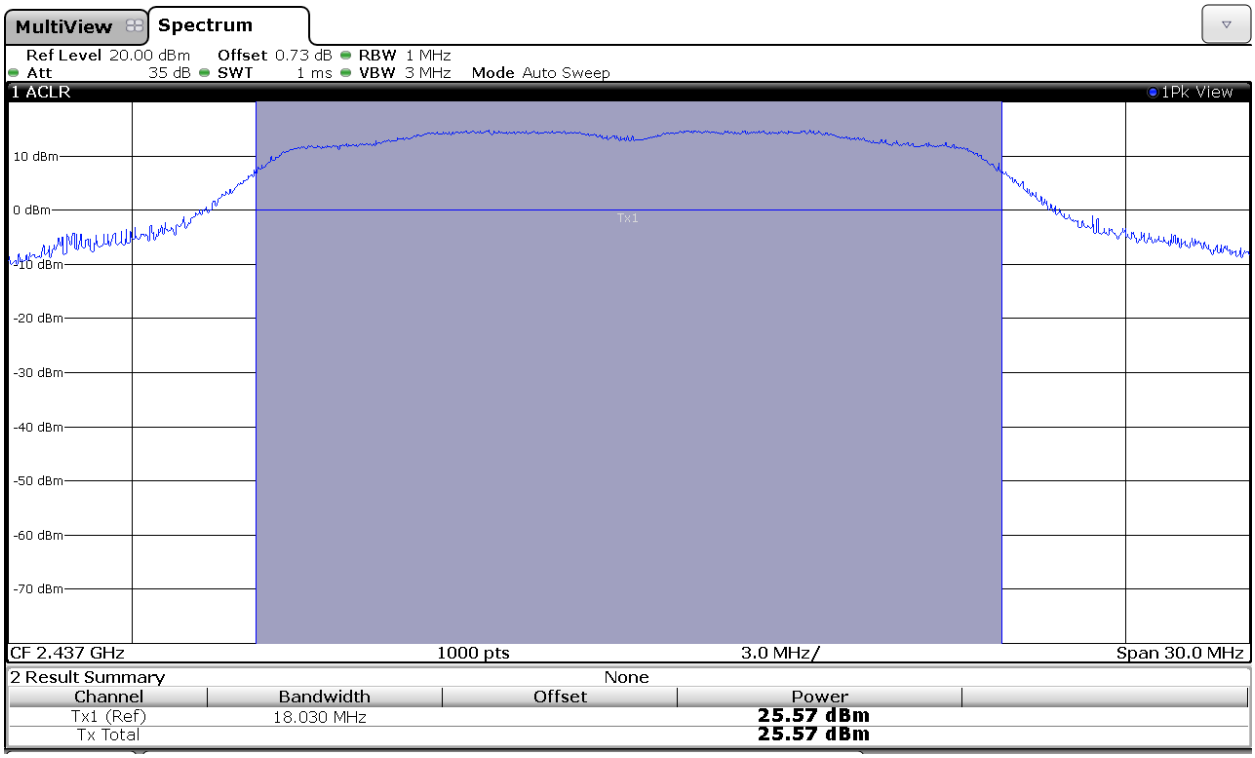


3. WiFi 2.4GHz 802.11 n20 mode

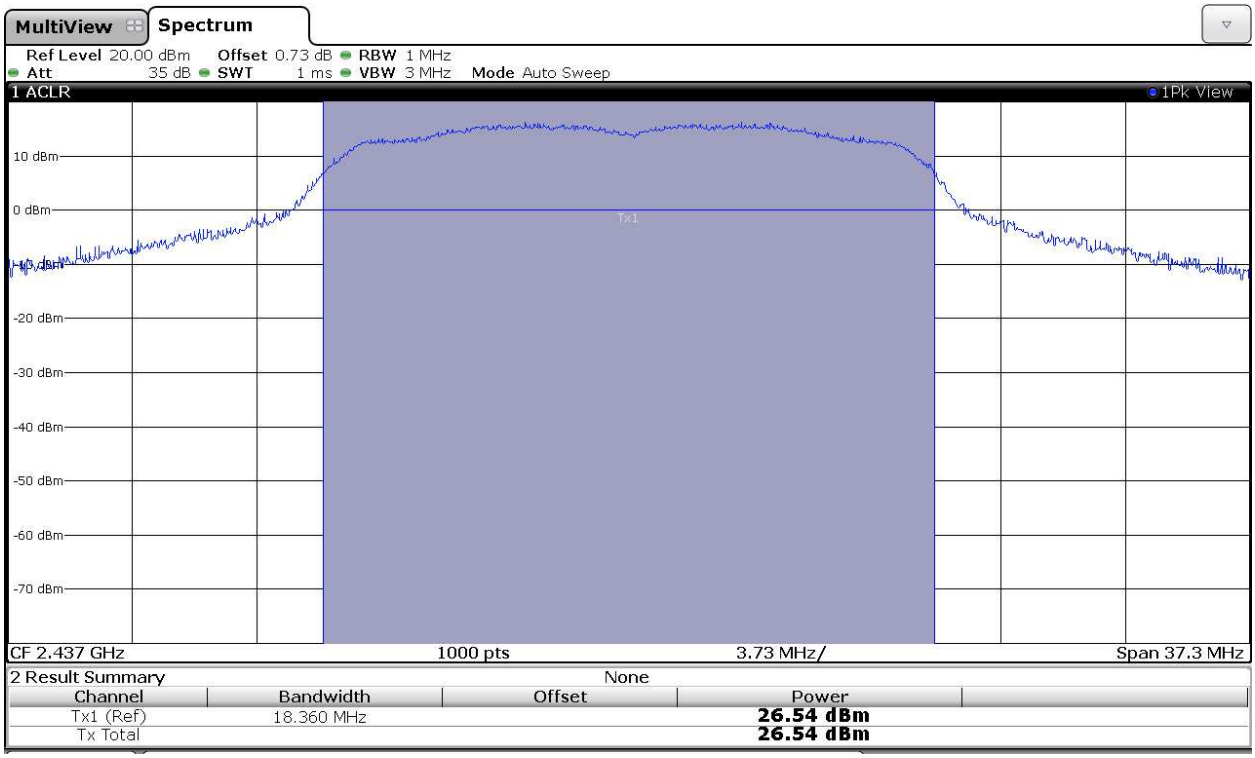
Peak conducted output power.
SISO mode. Middle frequency 2437 MHz. Chain B.



MIMO mode. Middle frequency 2437 MHz. Chain A.

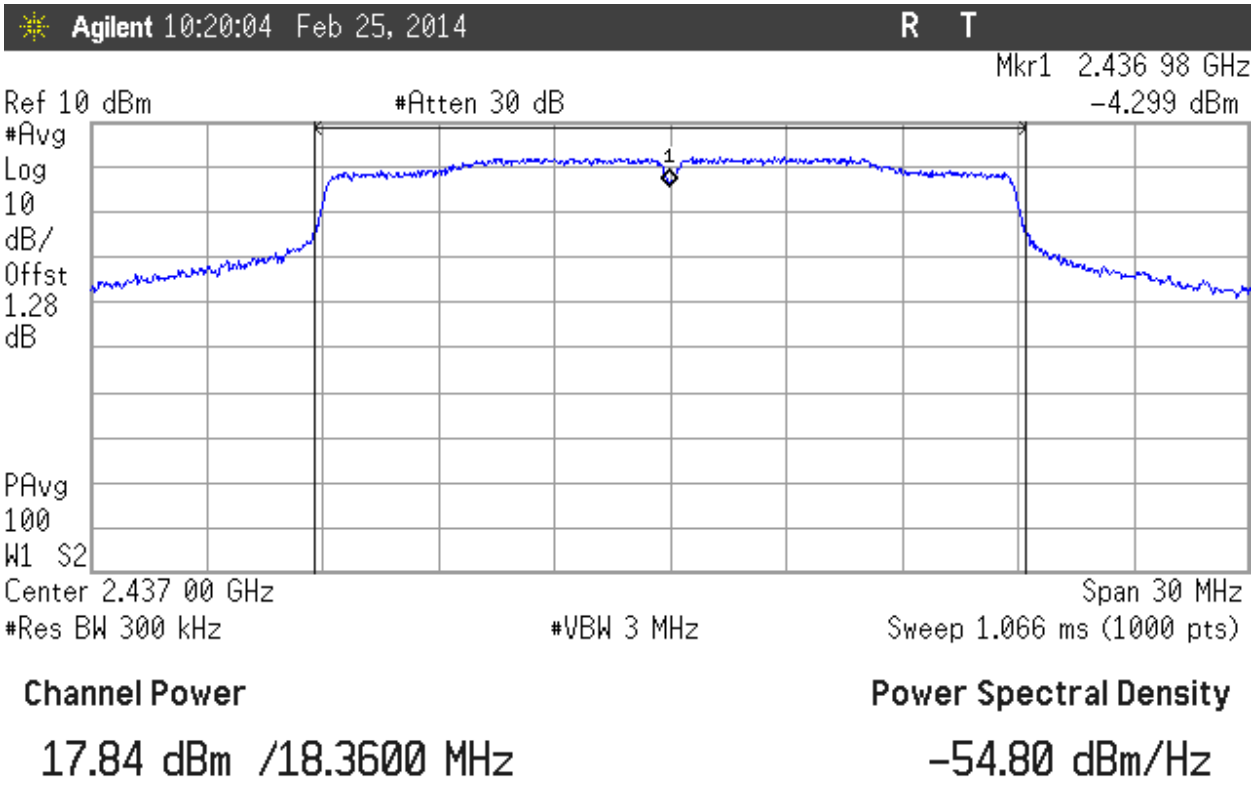


MIMO mode. Middle frequency 2437 MHz. Chain B.

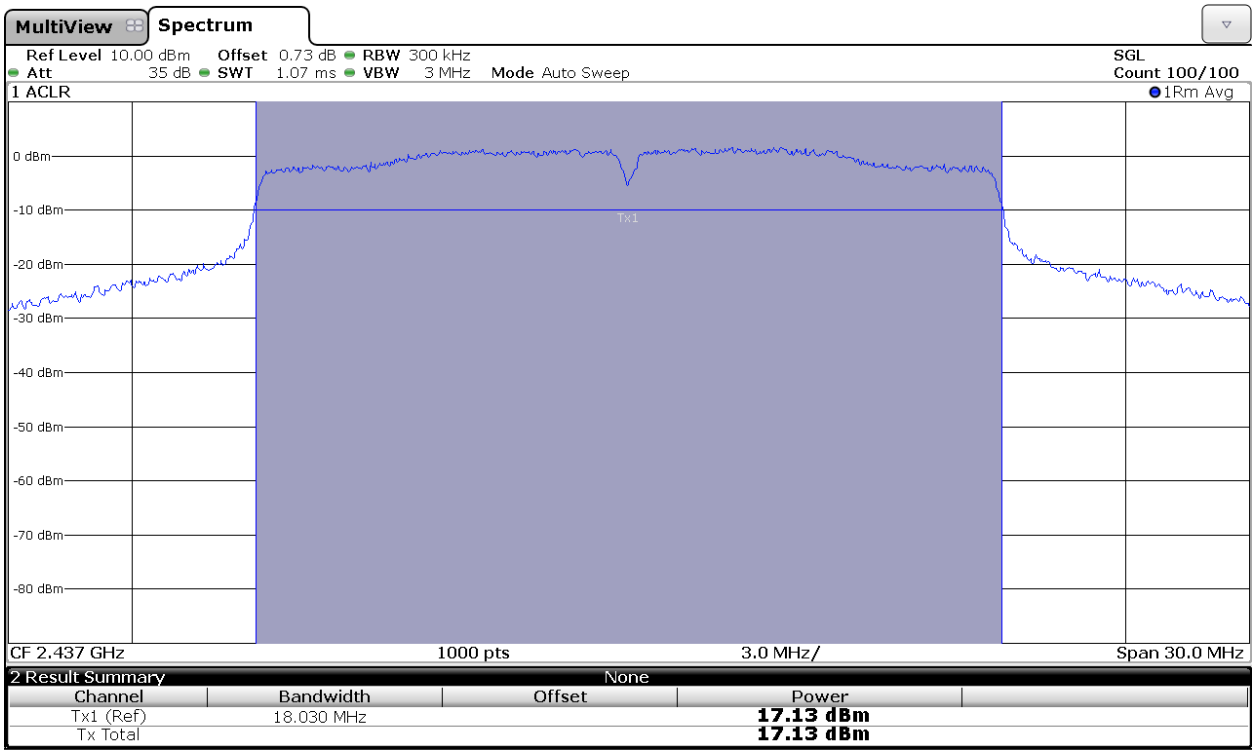


Conducted (average) output power (for information purposes only).

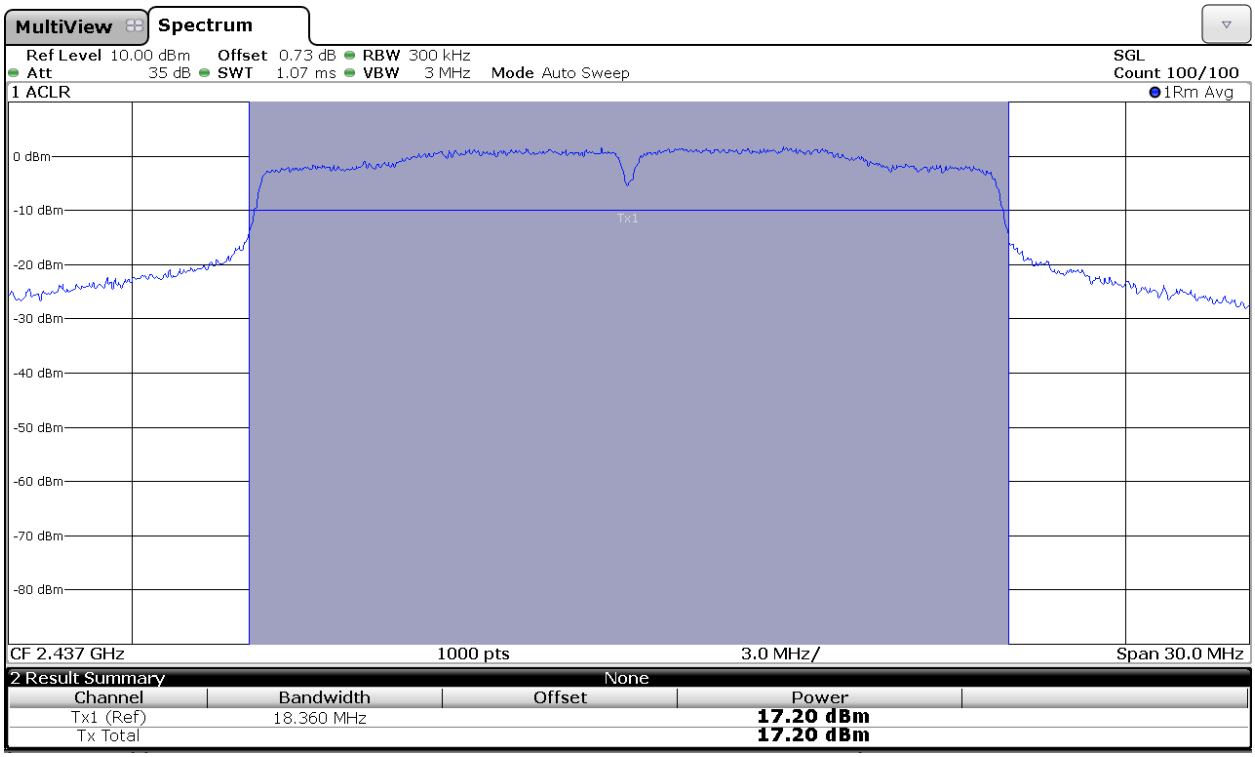
SISO mode. Middle frequency 2437 MHz. Chain B.



MIMO mode. Middle frequency 2437 MHz. Chain A.

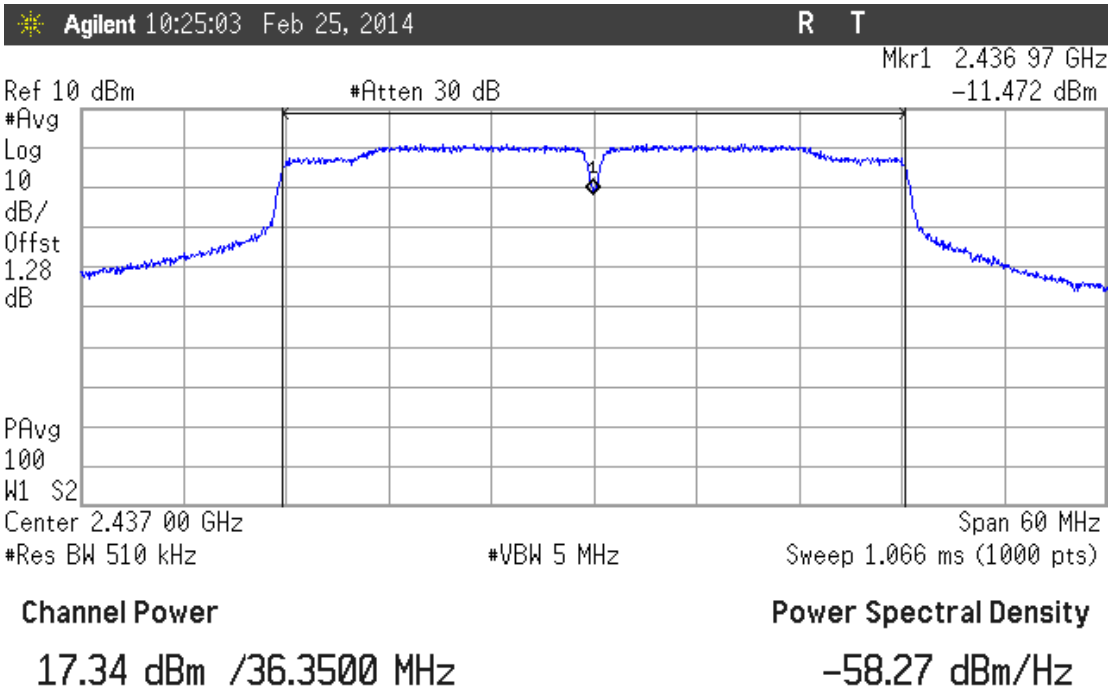


MIMO mode. Middle frequency 2437 MHz. Chain B.

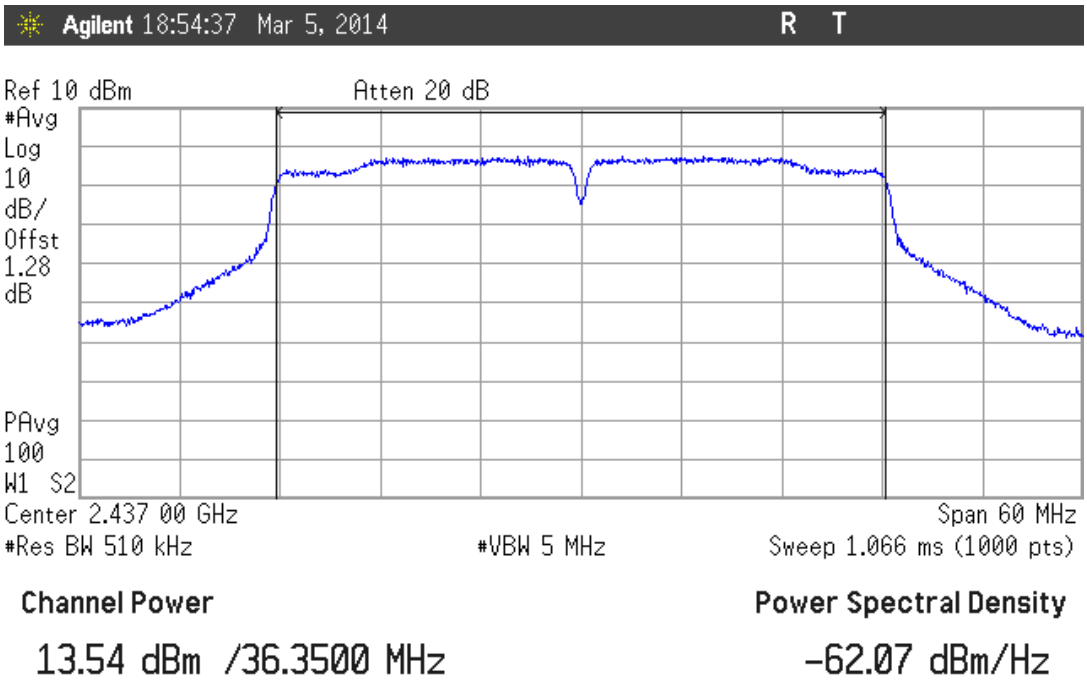


4. WiFi 2.4GHz 802.11 n40 mode

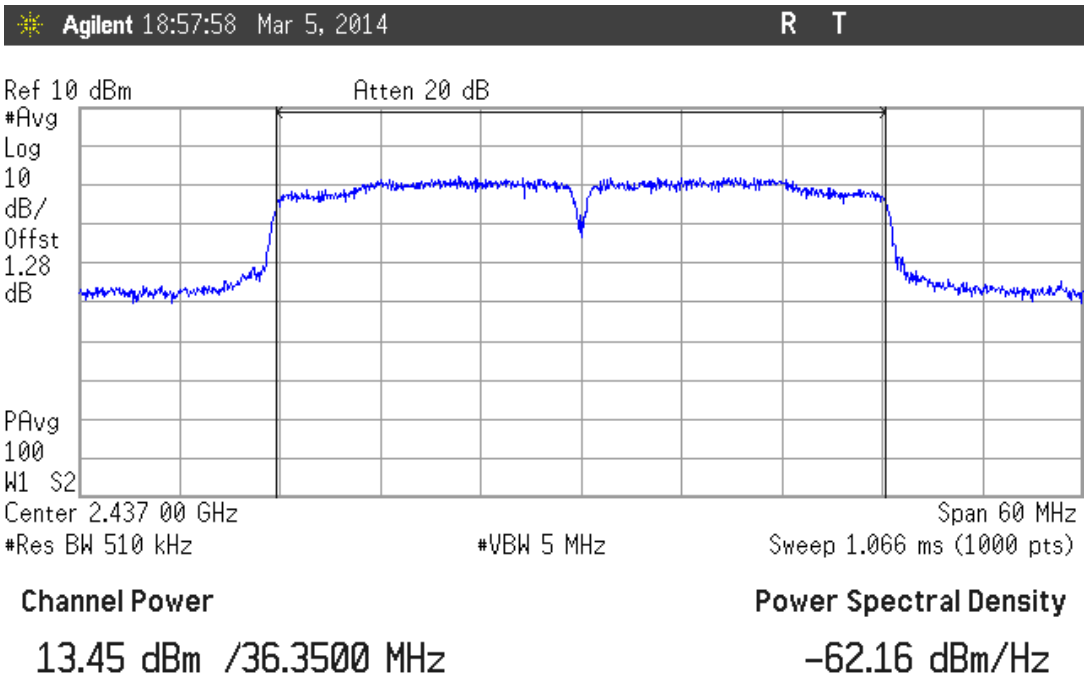
SISO mode. Middle frequency 2437 MHz. Chain B.



MIMO mode. Middle frequency 2437 MHz. Chain A.



MIMO mode. Middle frequency 2437 MHz. Chain B.



Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations conducted (Transmitter)

SPECIFICATION

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

RESULTS: (See next plots)

1. WiFi 2.4GHz 802.11 b mode

Reference Level Measurement

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Reference Level Measurement (dBm)	7.22	6.78	8.18	8.53	6.75	6.78
Measurement uncertainty (dB)	±1.5					

Chain A / B:

Lowest frequency 2412 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-22.78 / -23.22

Middle frequency 2437 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-21.82 / -21.47

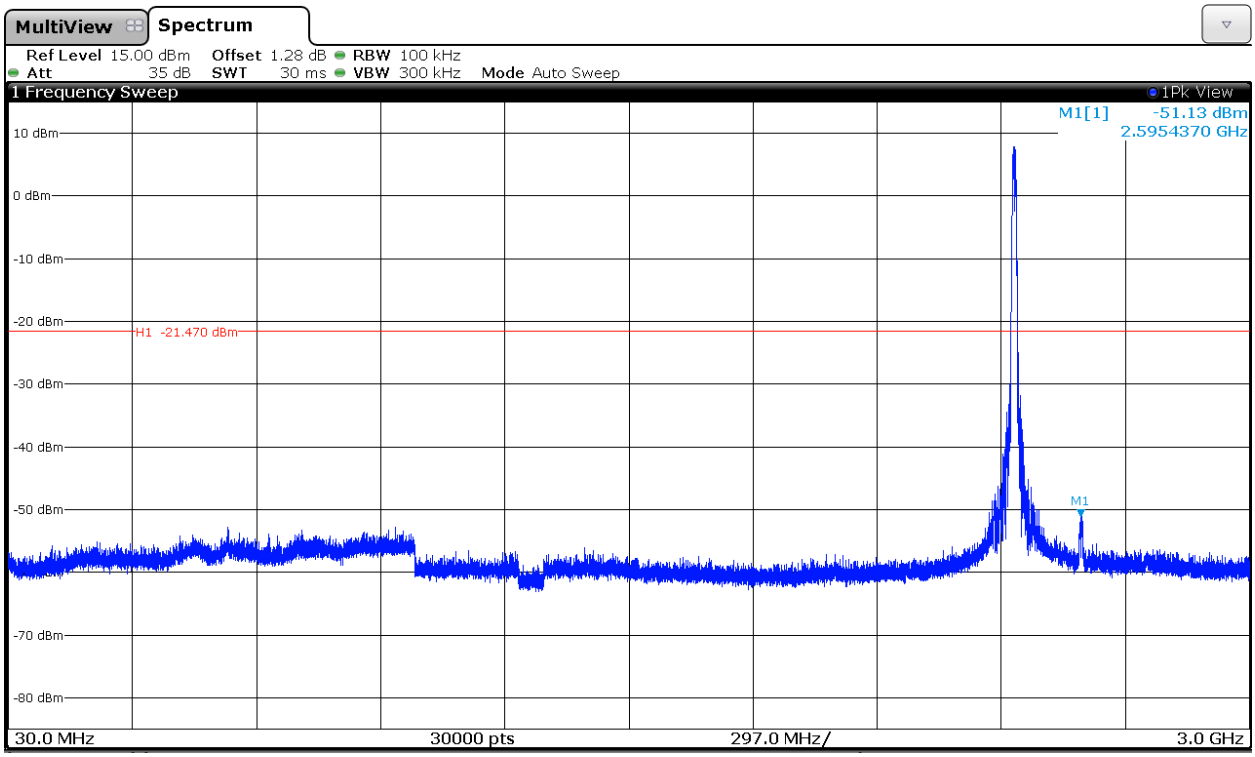
Highest frequency 2462 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-23.25 / -23.22

Verdict: PASS

See next plots of worst case: Mode b. Middle Channel: 2437 MHz. Chain B.

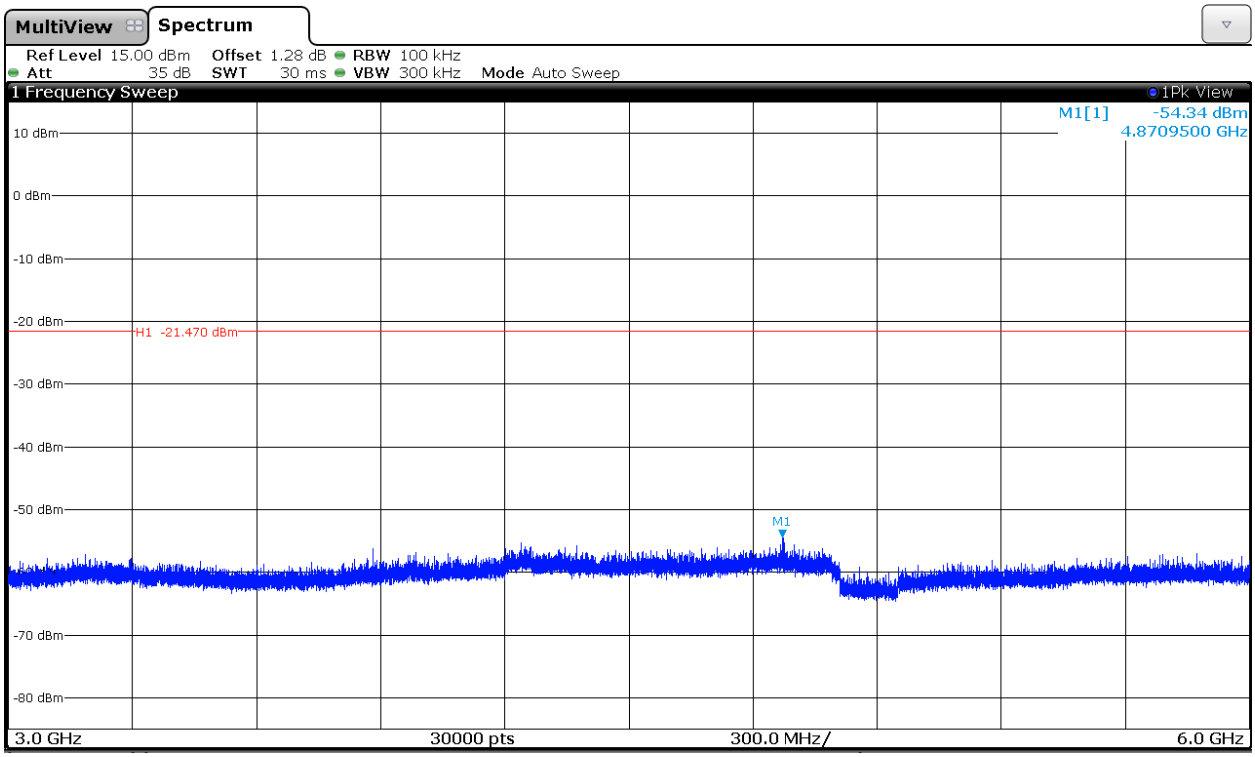
Number of sweep points: 30,000.

Plot 30 MHz to 3 GHz:

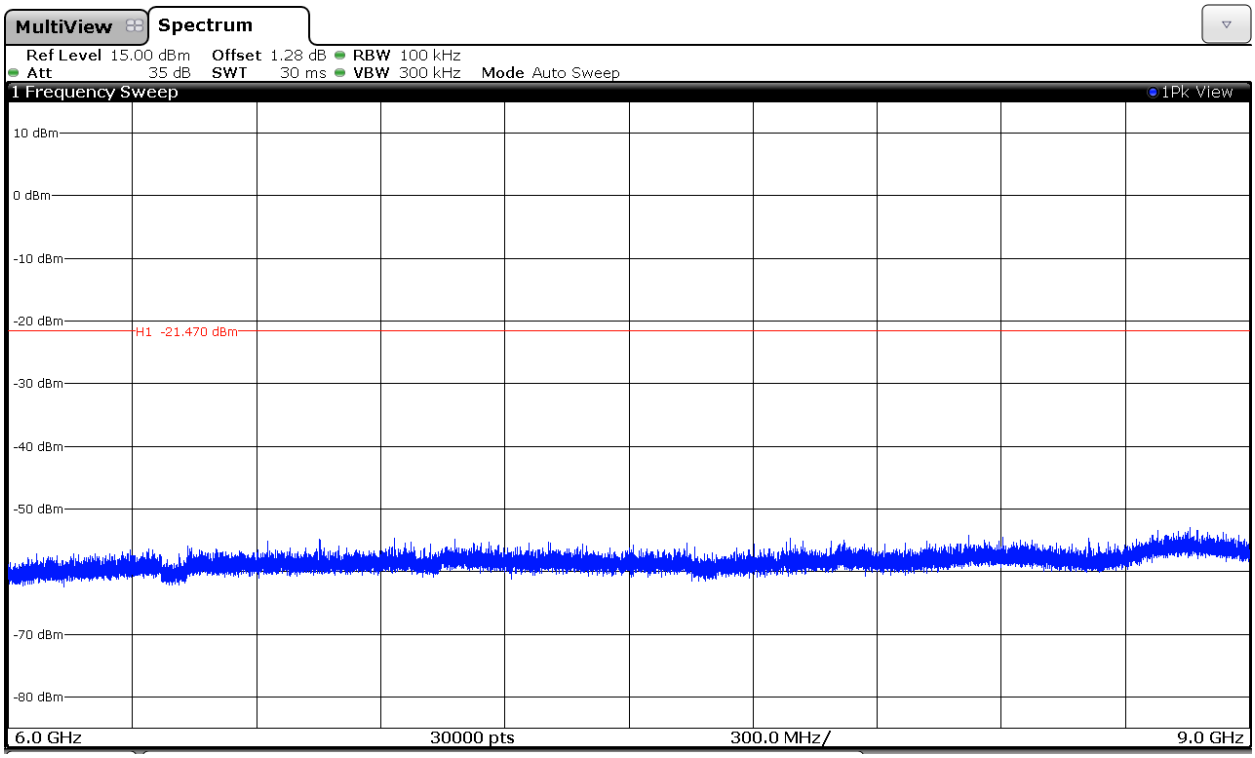


Note: The peak above the limit is the carrier frequency.

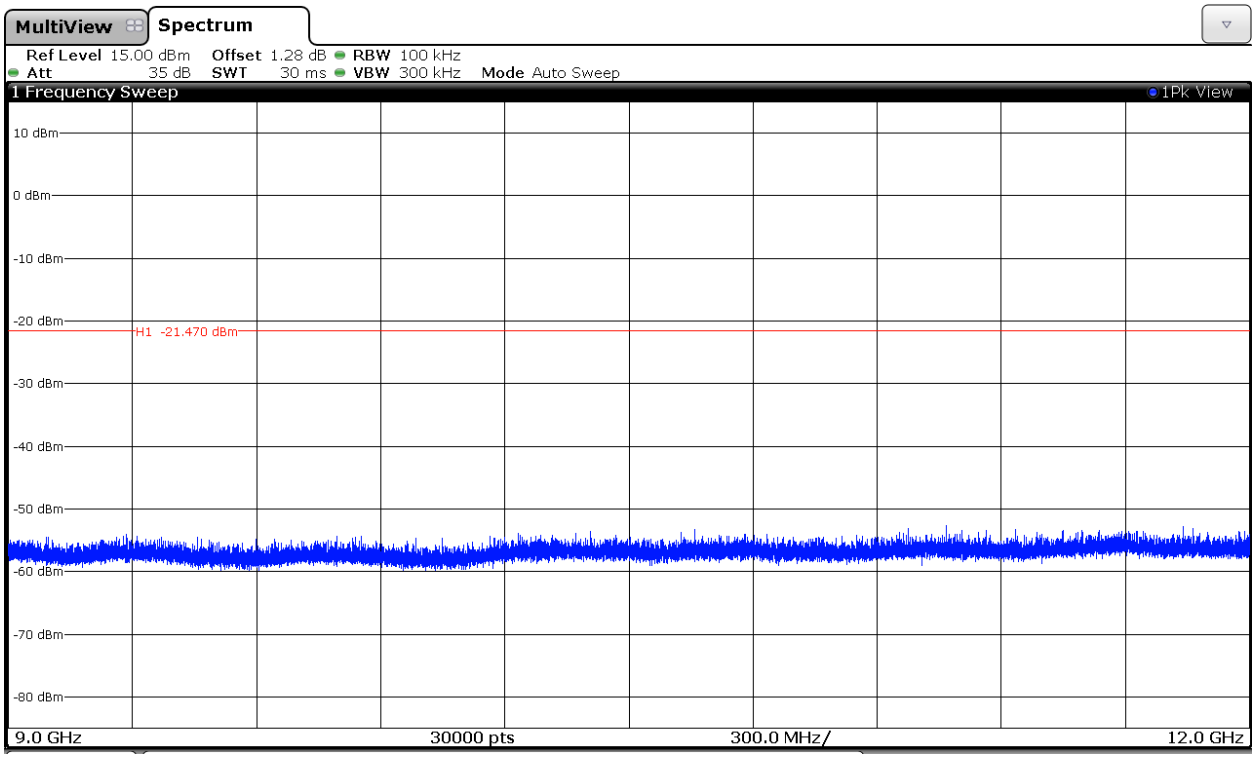
Plot 3 GHz to 6 GHz:



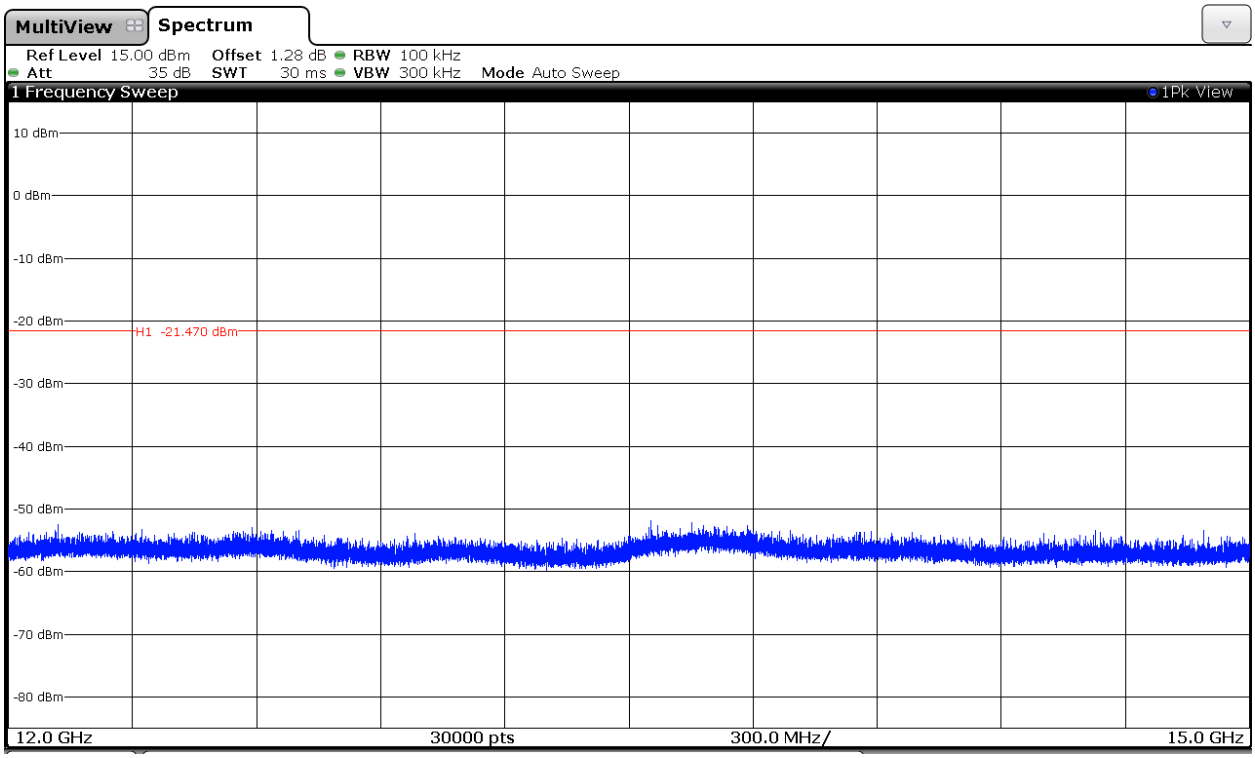
Plot 6 GHz to 9 GHz:



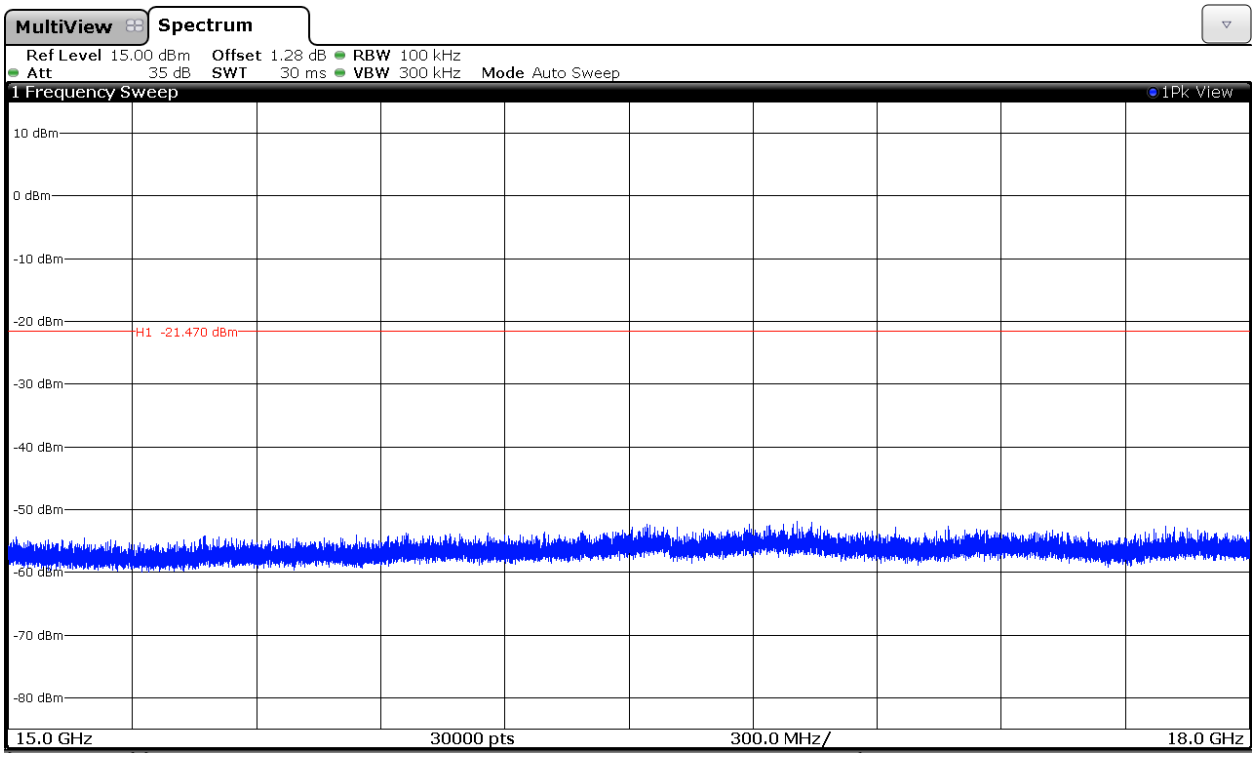
Plot 9 GHz to 12 GHz:



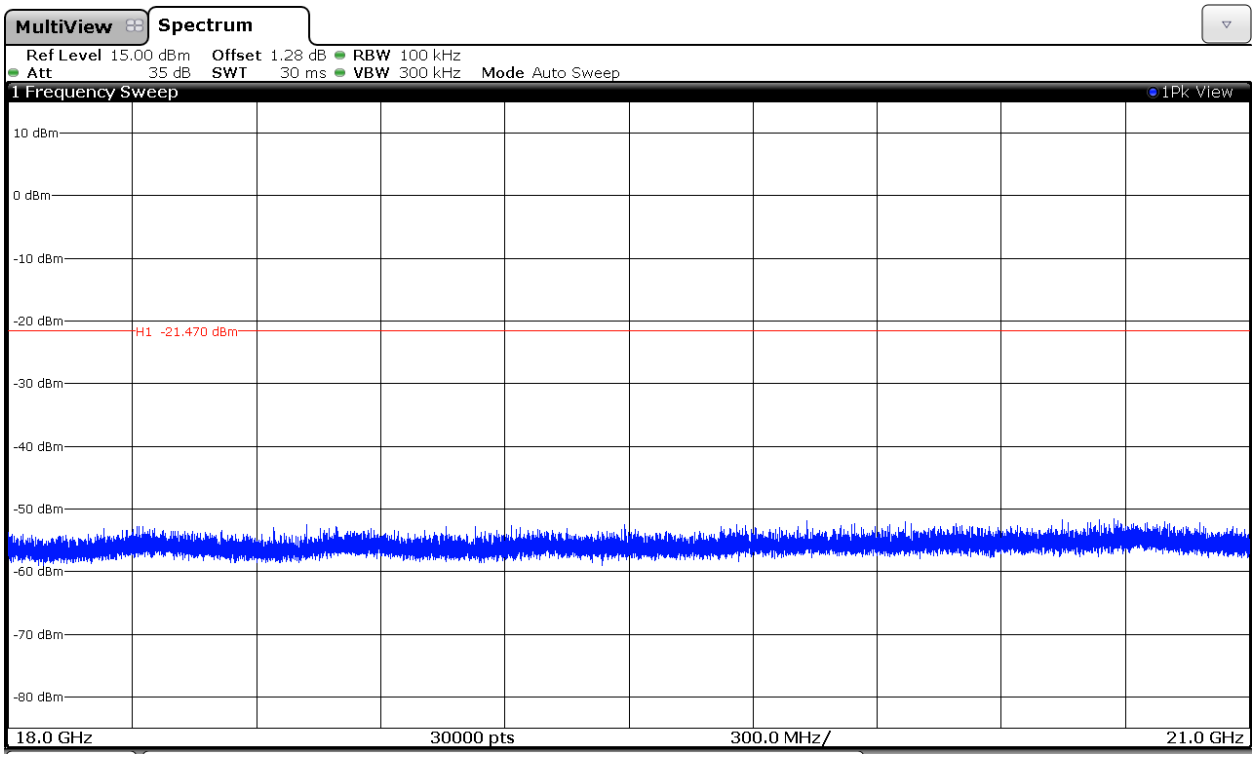
Plot 12 GHz to 15 GHz:



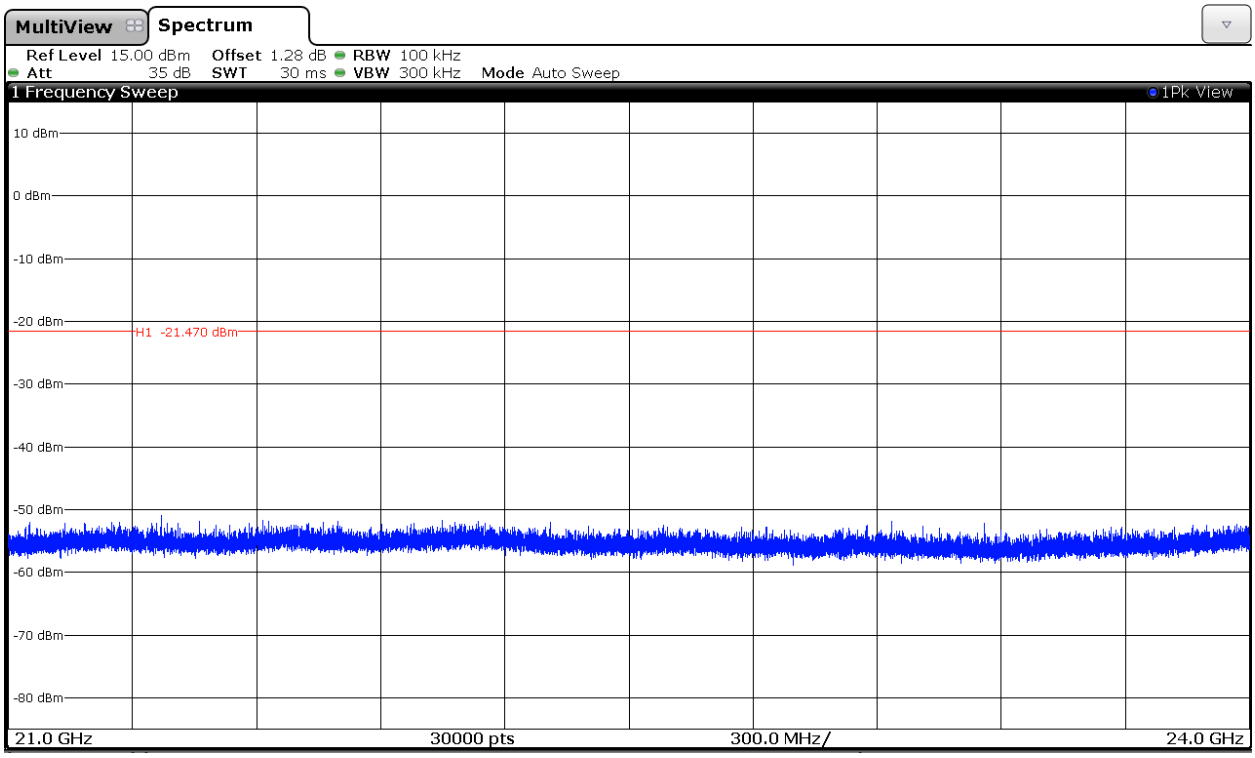
Plot 15 GHz to 18 GHz:



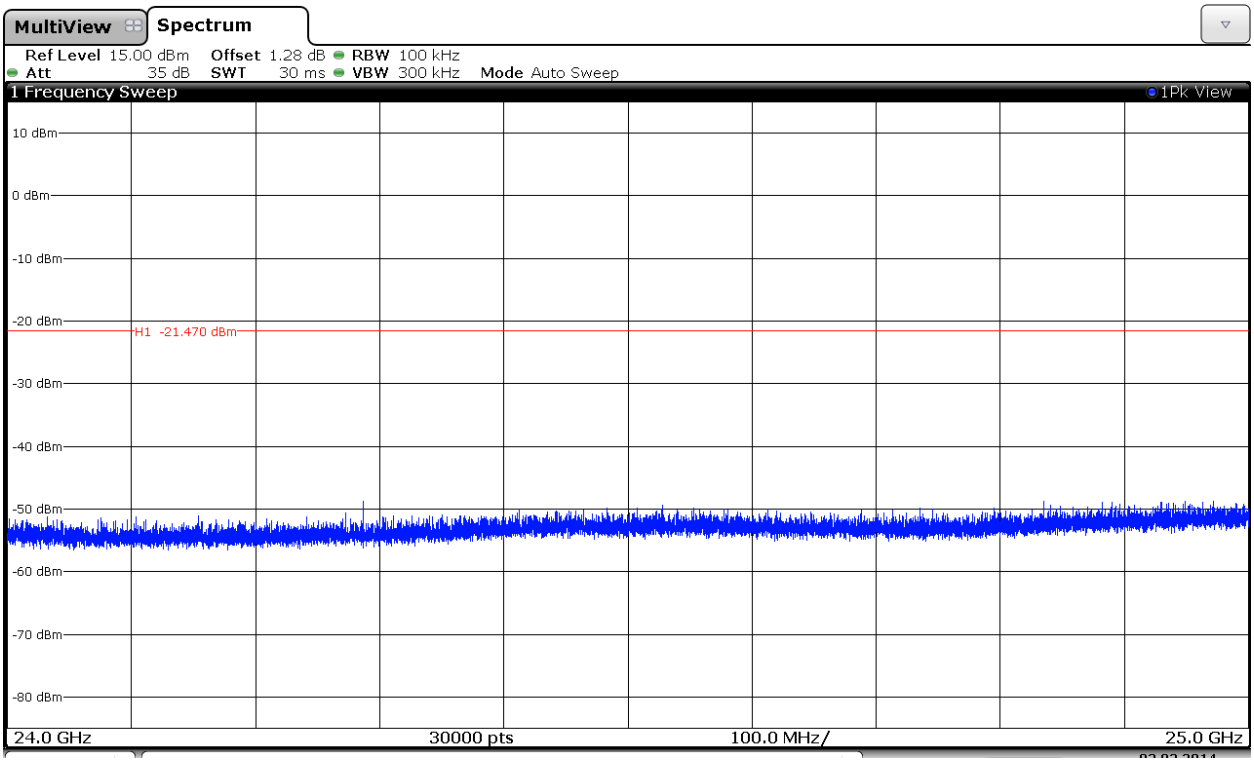
Plot 18 GHz to 21 GHz:



Plot 21 GHz to 24 GHz:



Plot 24GHz to 25 GHz:



2. WiFi 2.4GHz 802.11 g mode

Reference Level Measurement

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Reference Level Measurement (dBm)	3.40	3.09	6.47	6.72	1.43	1.32
Measurement uncertainty (dB)	±1.5					

Chain A / B:

Lowest frequency 2412 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-16.60 / -16.91

Middle frequency 2437 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-13.53 / -13.28

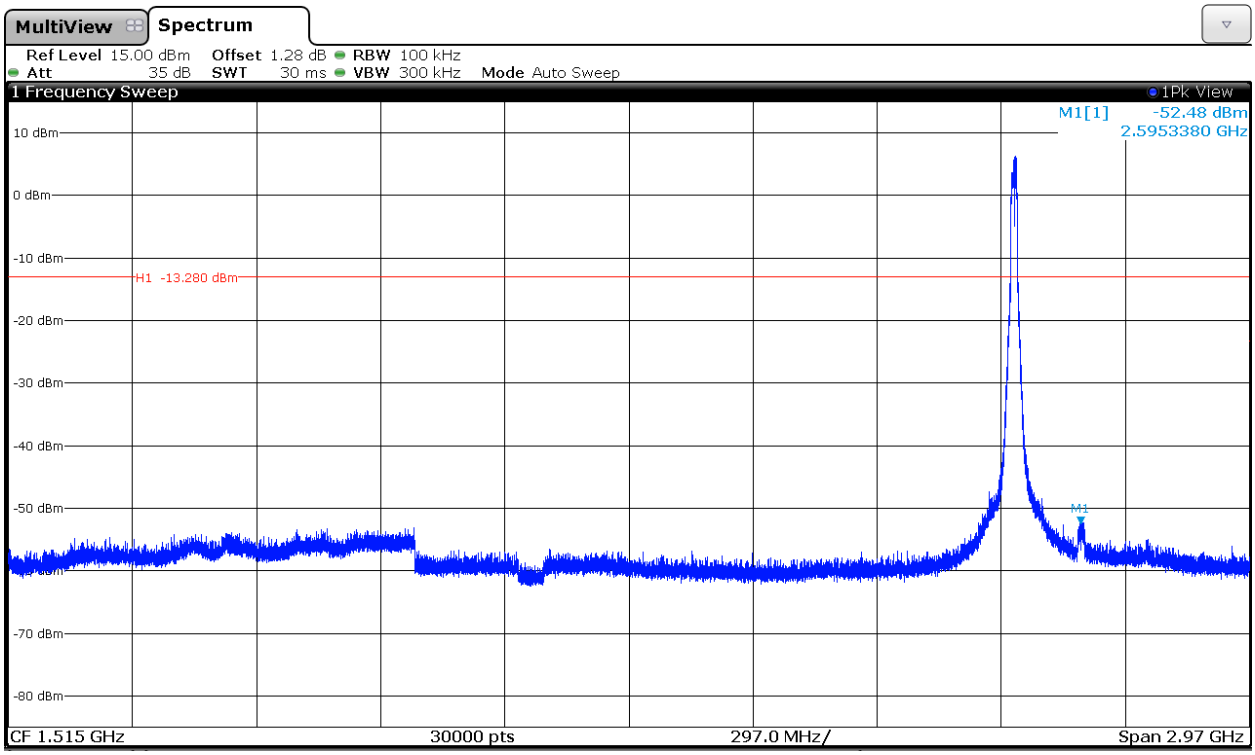
Highest frequency 2462 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-18.57 / -18.68

Verdict: PASS (NOTE: The limit is set to -20 dBc since the maximum peak conducted output power was measured for this mode.)

See next plots of worst case: Mode g. Middle Channel: 2437 MHz. Chain B.

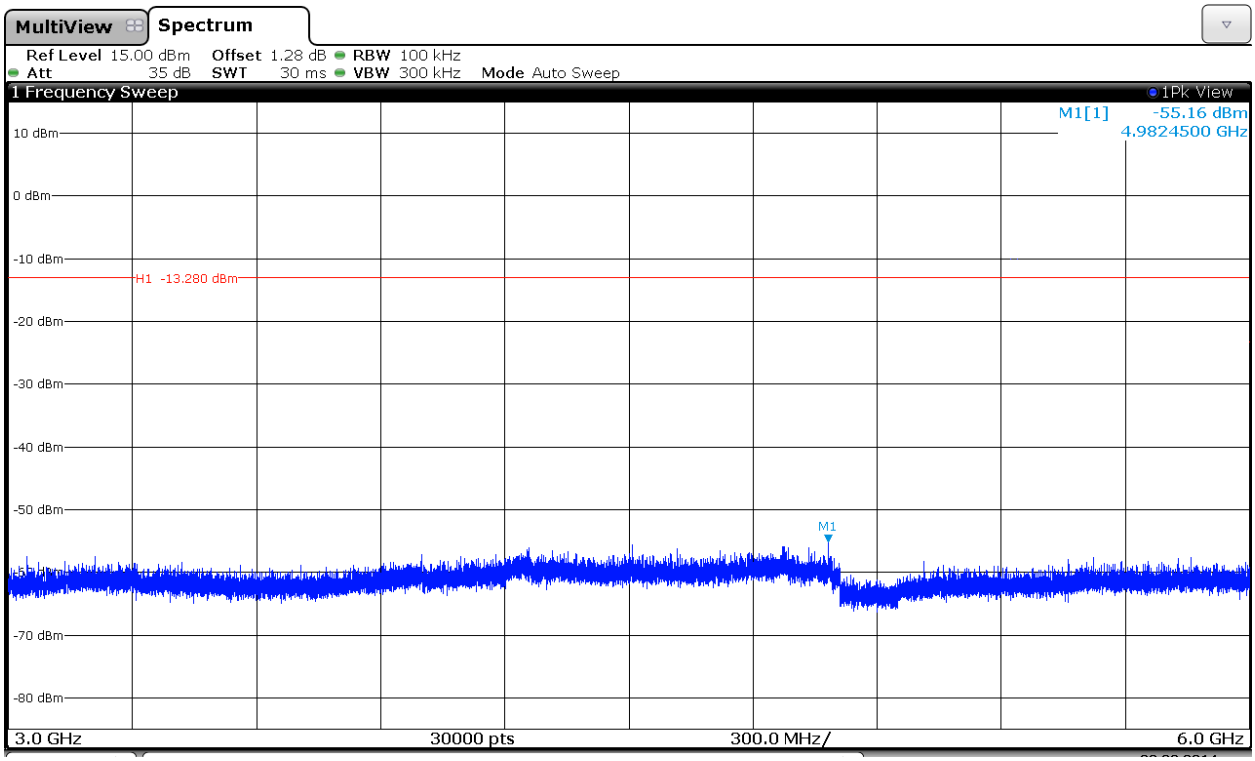
Number of sweep points: 30,000.

Plot 30 MHz to 3 GHz:

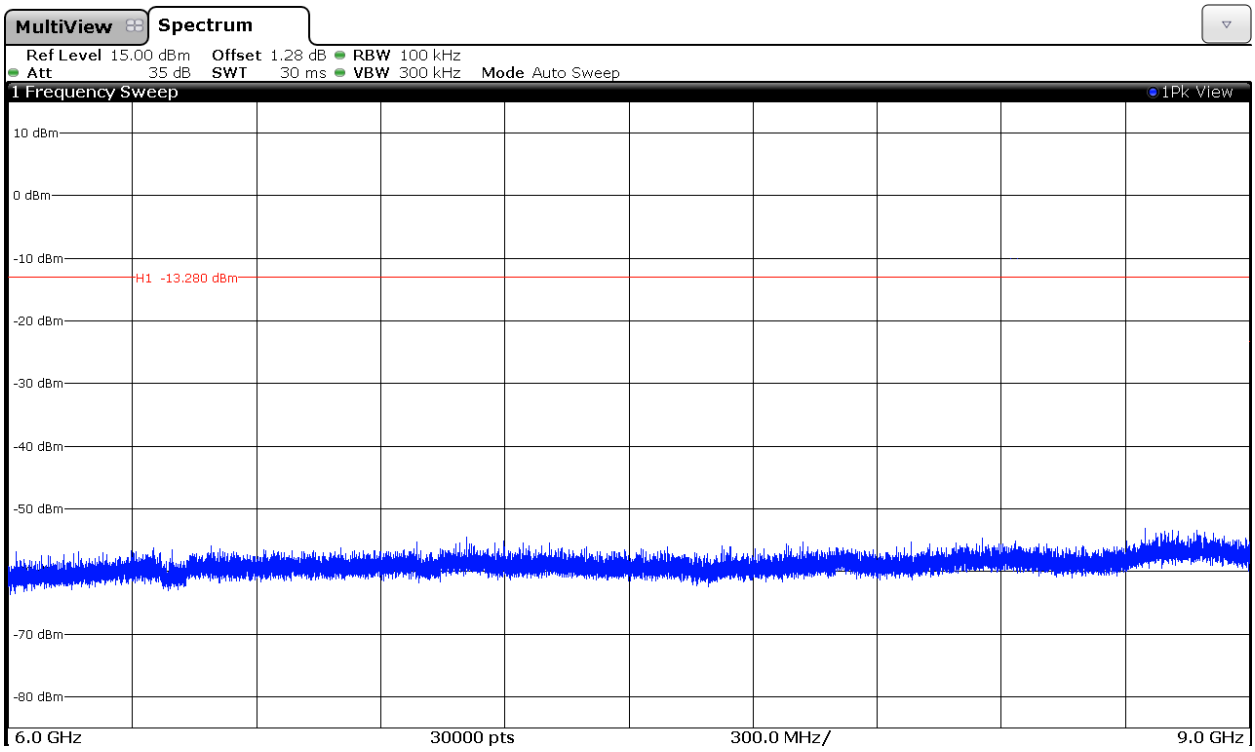


Note: The peak above the limit is the carrier frequency.

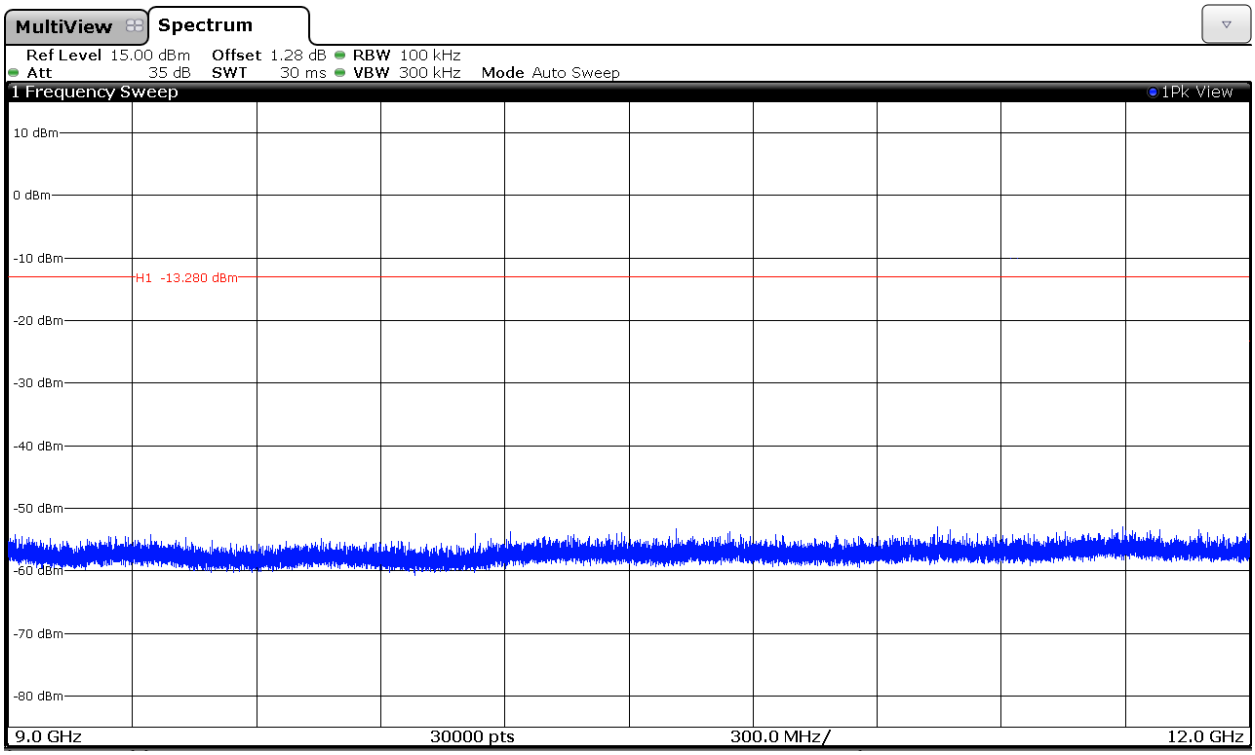
Plot 3 GHz to 6 GHz:



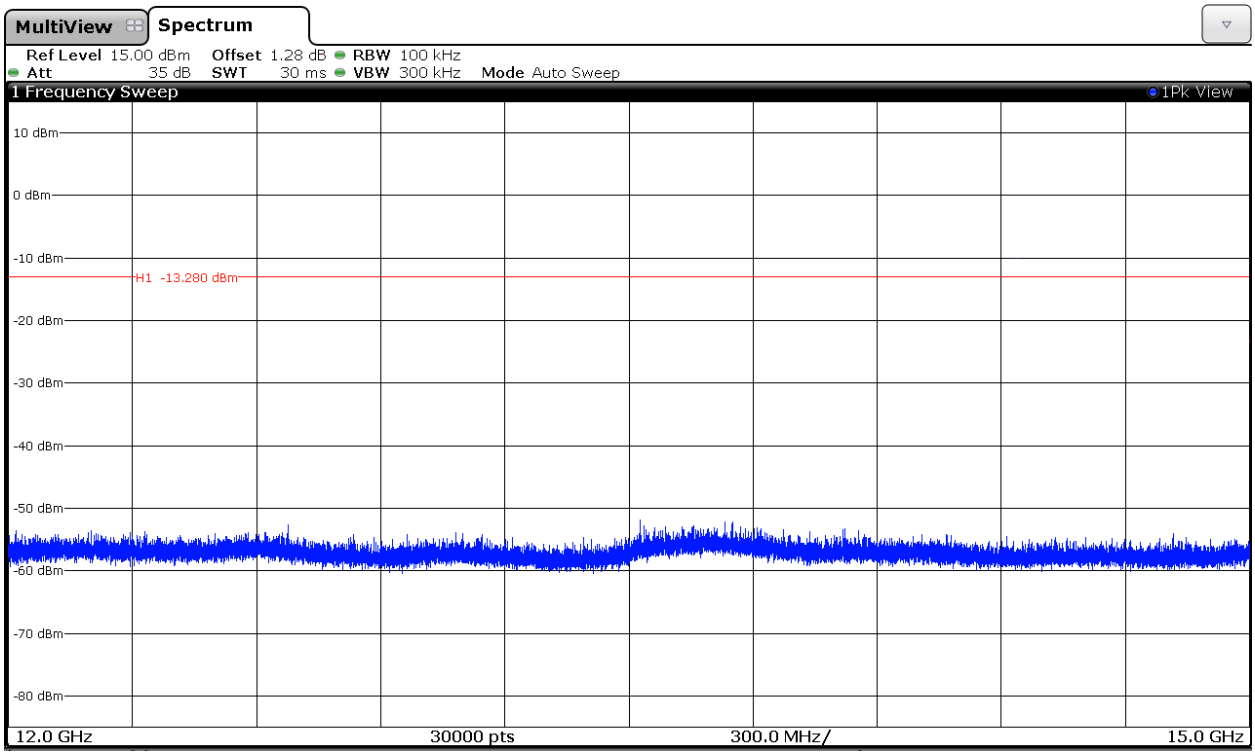
Plot 6 GHz to 9 GHz:



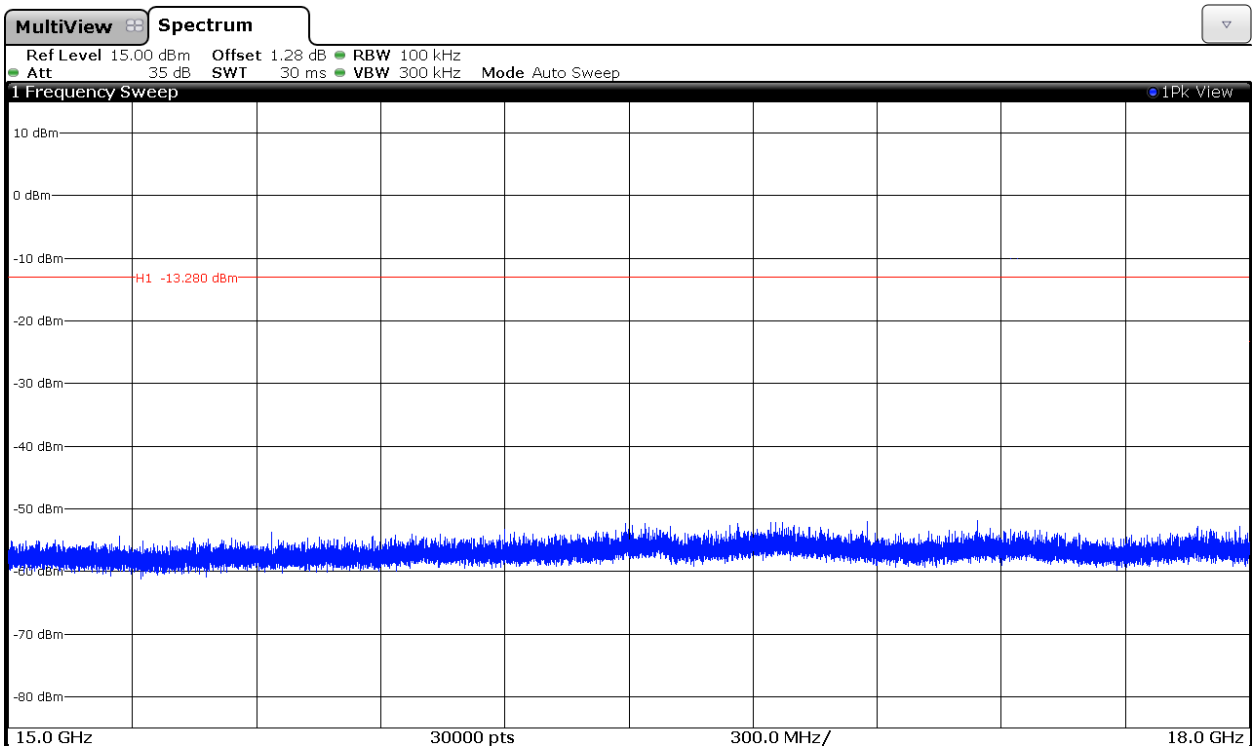
Plot 9 GHz to 12 GHz:



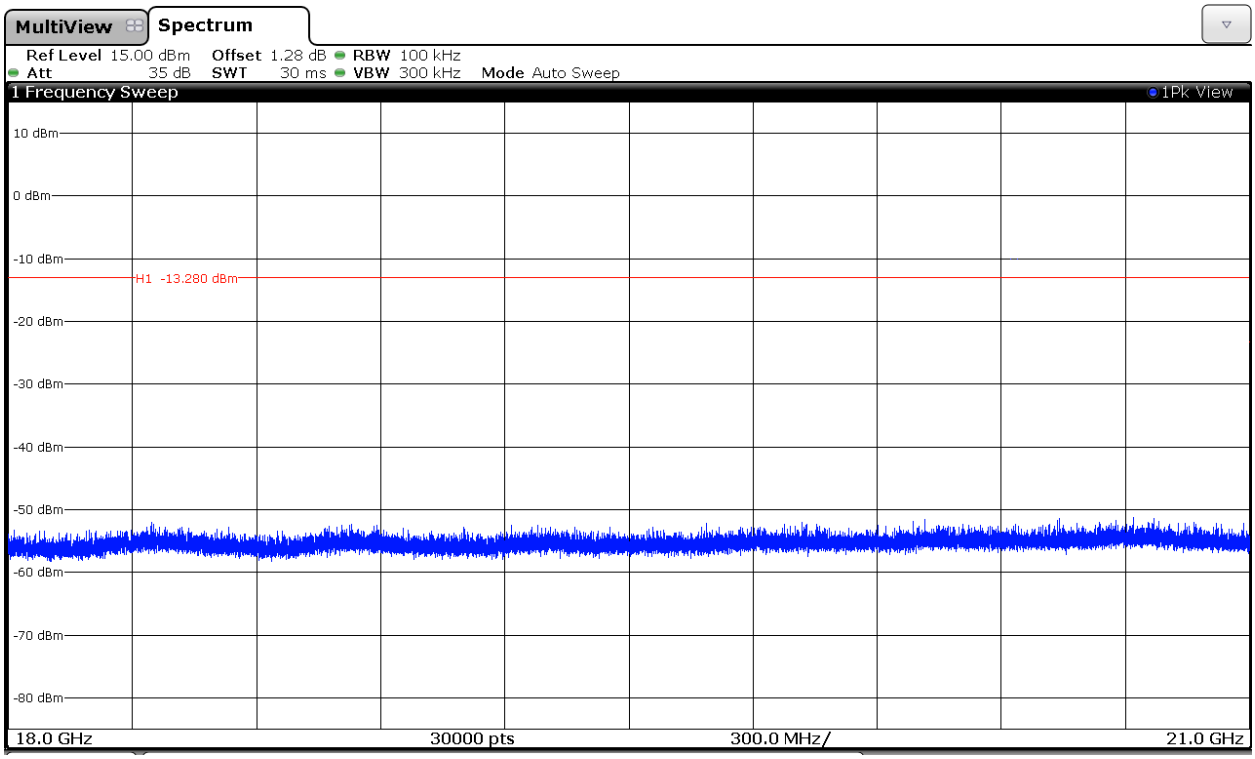
Plot 12 GHz to 15 GHz:



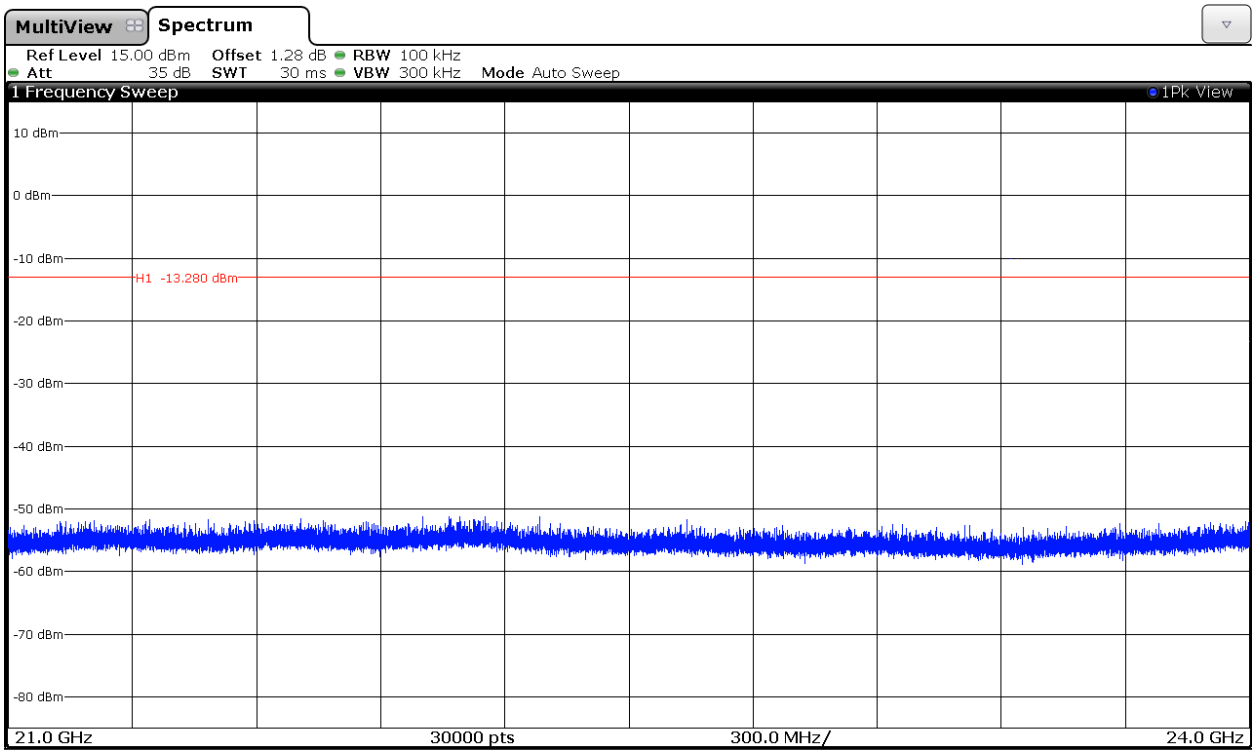
Plot 15 GHz to 18 GHz:



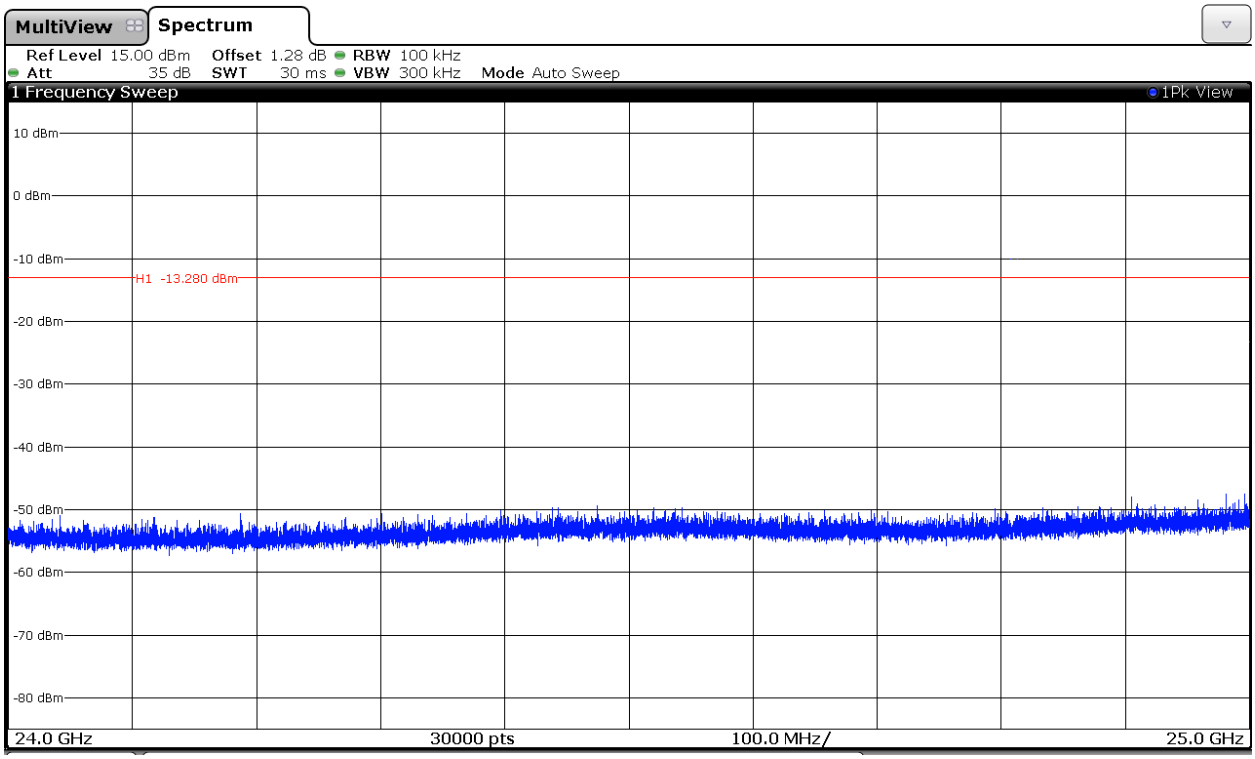
Plot 18 GHz to 21 GHz:



Plot 21 GHz to 24 GHz:



Plot 24GHz to 25 GHz:



3. WiFi 2.4GHz 802.11 n20 mode

Reference Level Measurement

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Reference Level Measurement (dBm)	3.27	3.59	6.40	7.14	1.40	1.08
Measurement uncertainty (dB)	±1.5					

Chain A / B:

Lowest frequency 2412 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-16.73 / -16.41

Middle frequency 2437 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-13.60 / -12.86

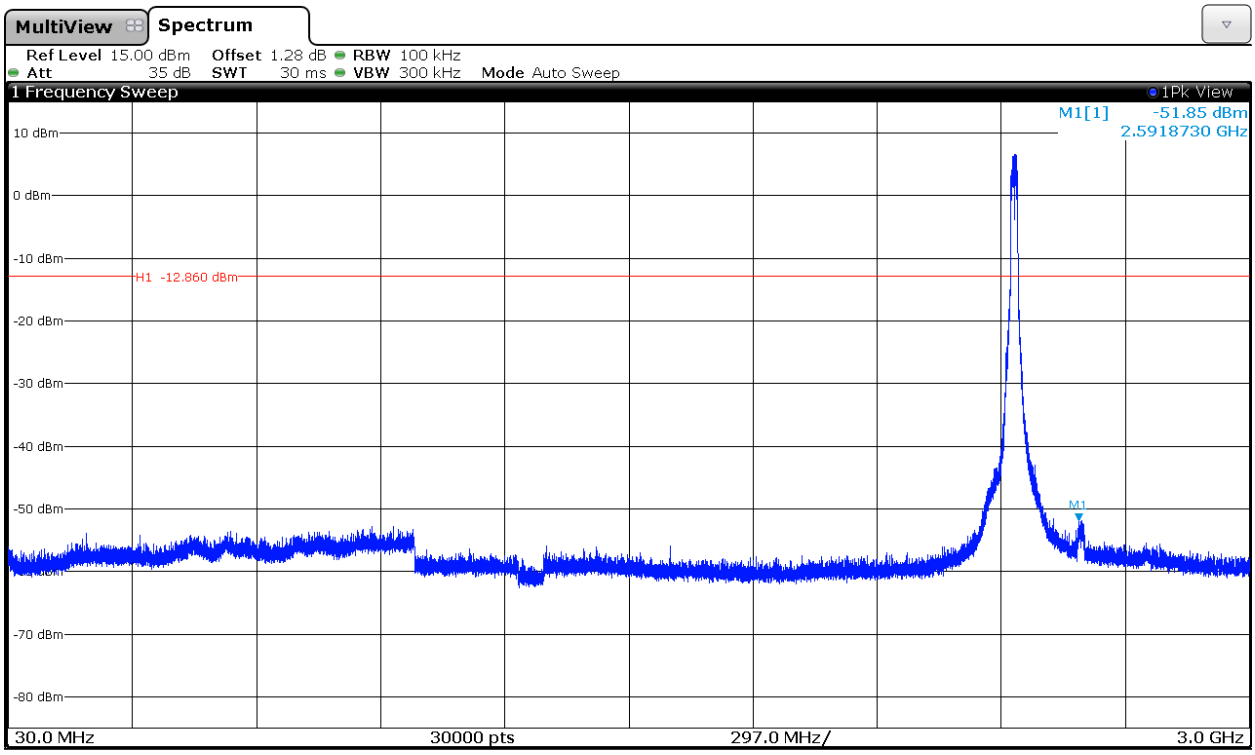
Highest frequency 2462 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-18.60 / -18.92

Verdict: PASS (NOTE: The limit is set to -20 dBc since the maximum peak conducted output power was measured for this mode.)

See next plots of worst case: Mode n20. Middle Channel: 2437 MHz. Chain B.

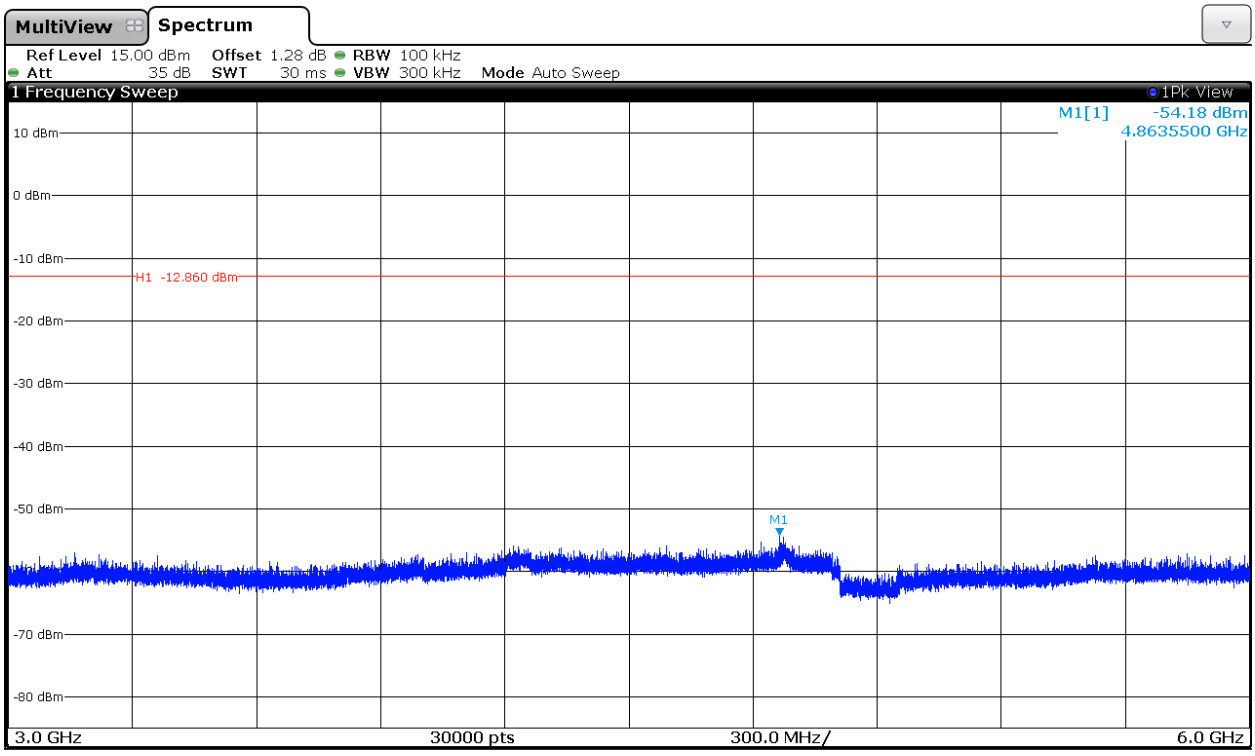
Number of sweep points: 30,000.

Plot 30 MHz to 3 GHz:

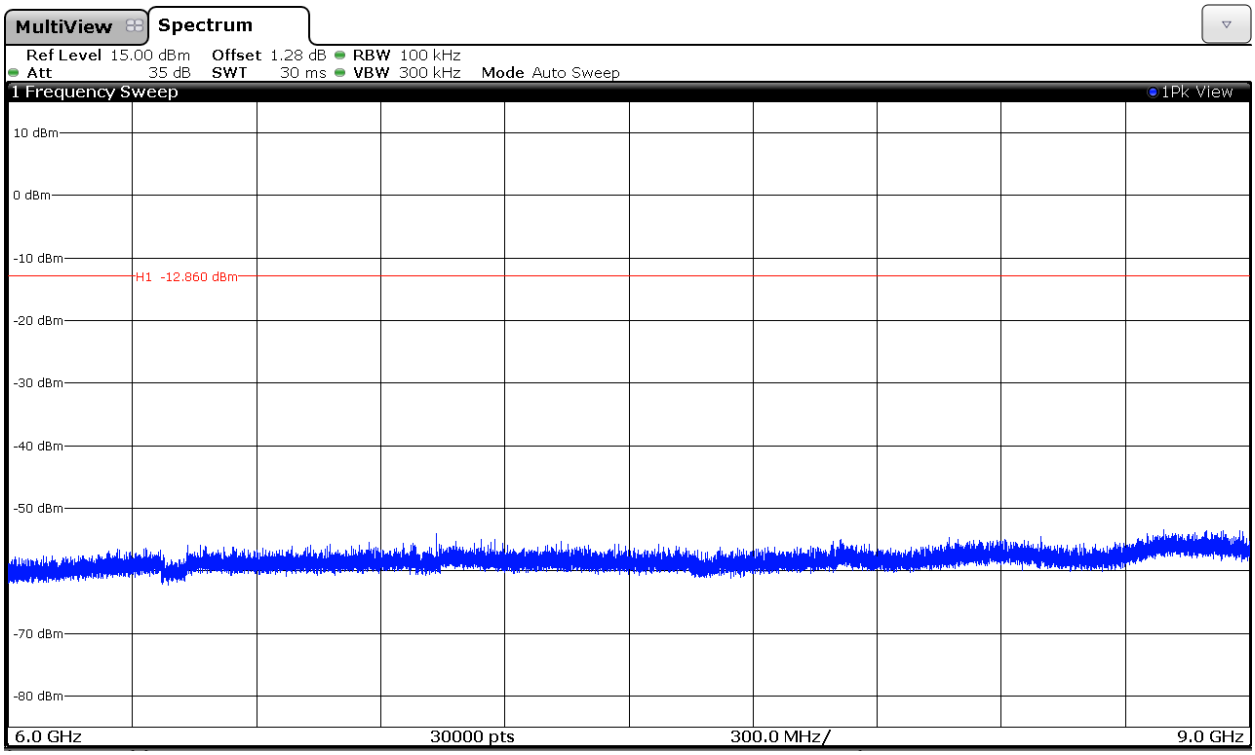


Note: The peak above the limit is the carrier frequency.

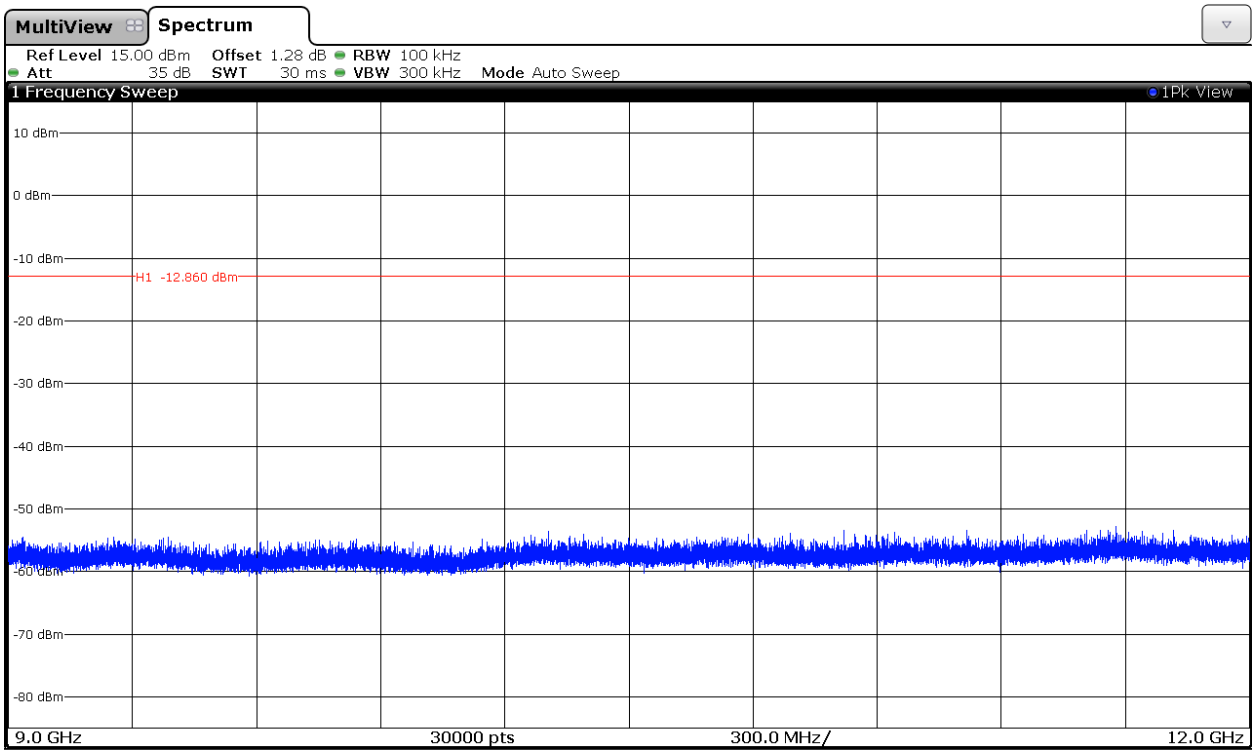
Plot 3 GHz to 6 GHz:



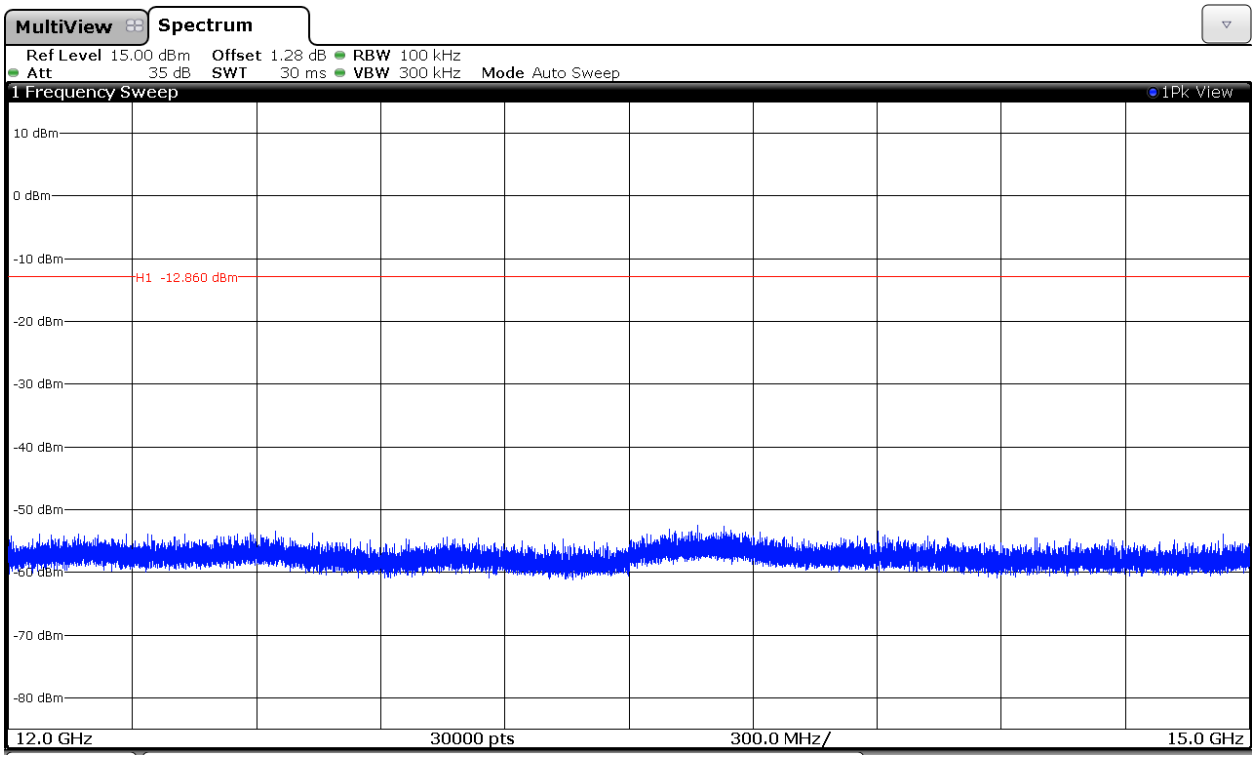
Plot 6 GHz to 9 GHz:



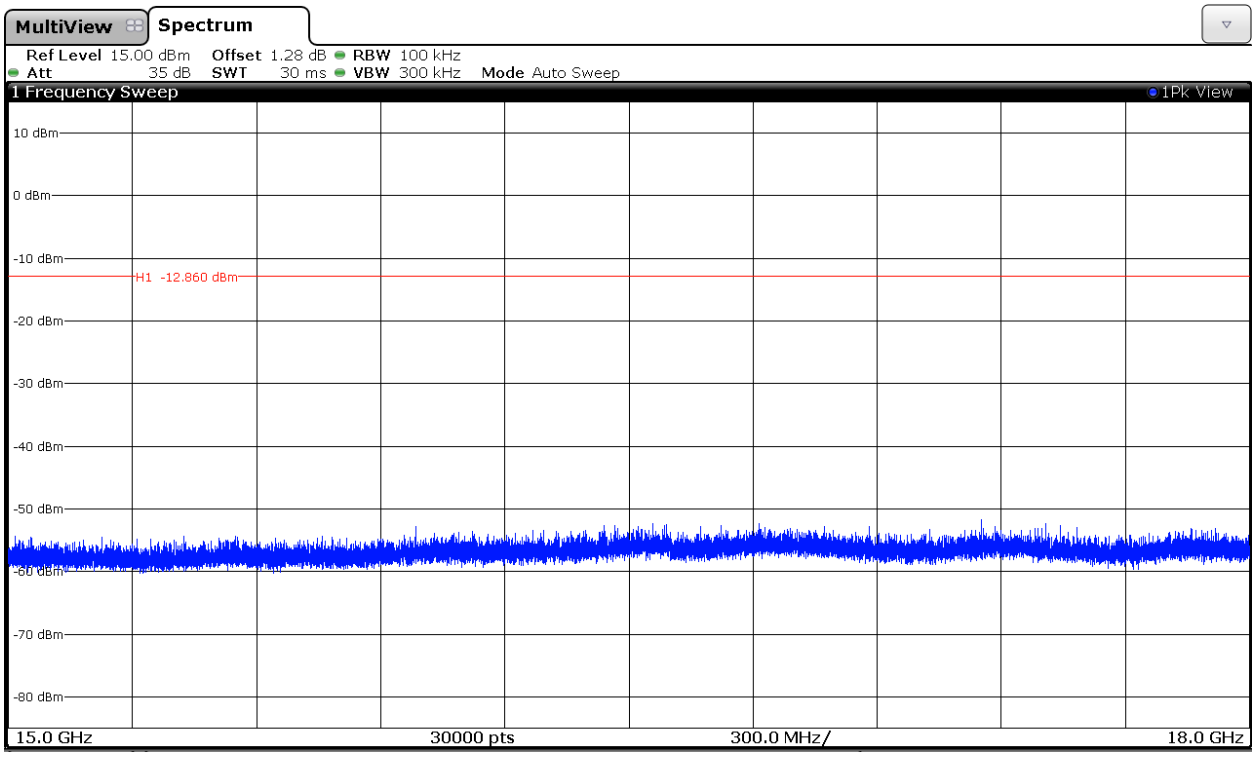
Plot 9 GHz to 12 GHz:



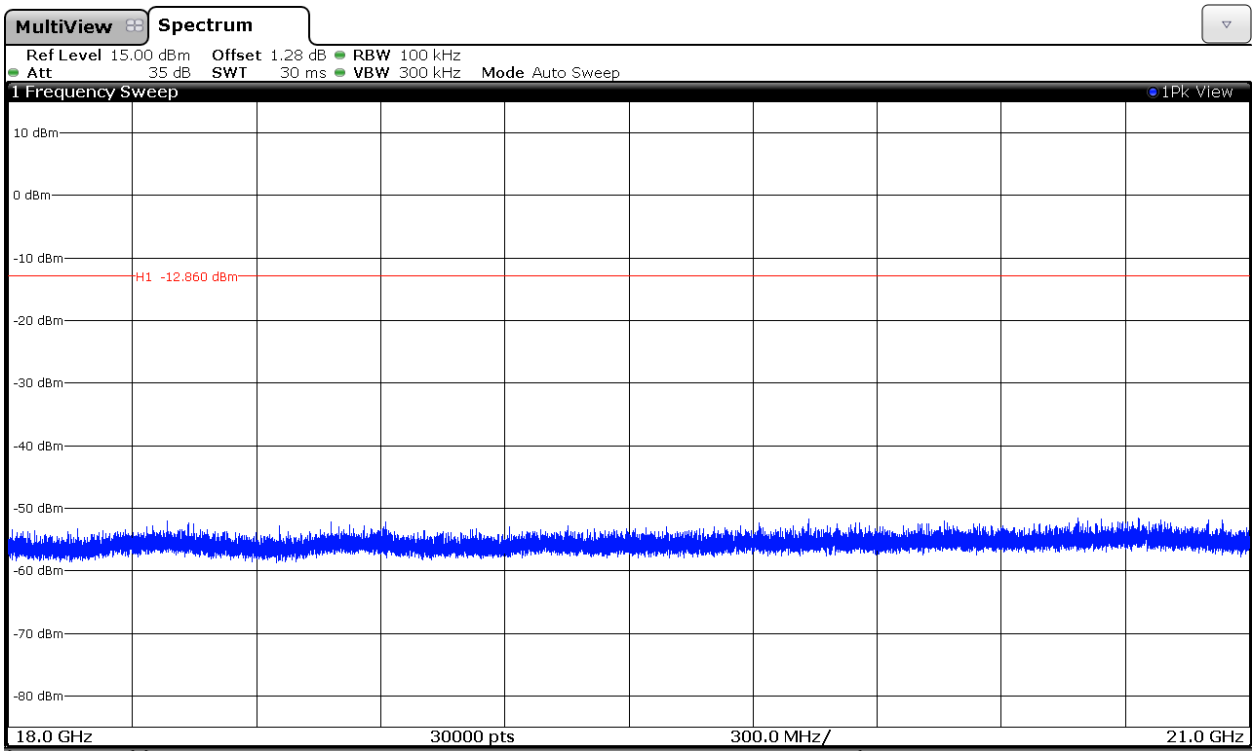
Plot 12 GHz to 15 GHz:



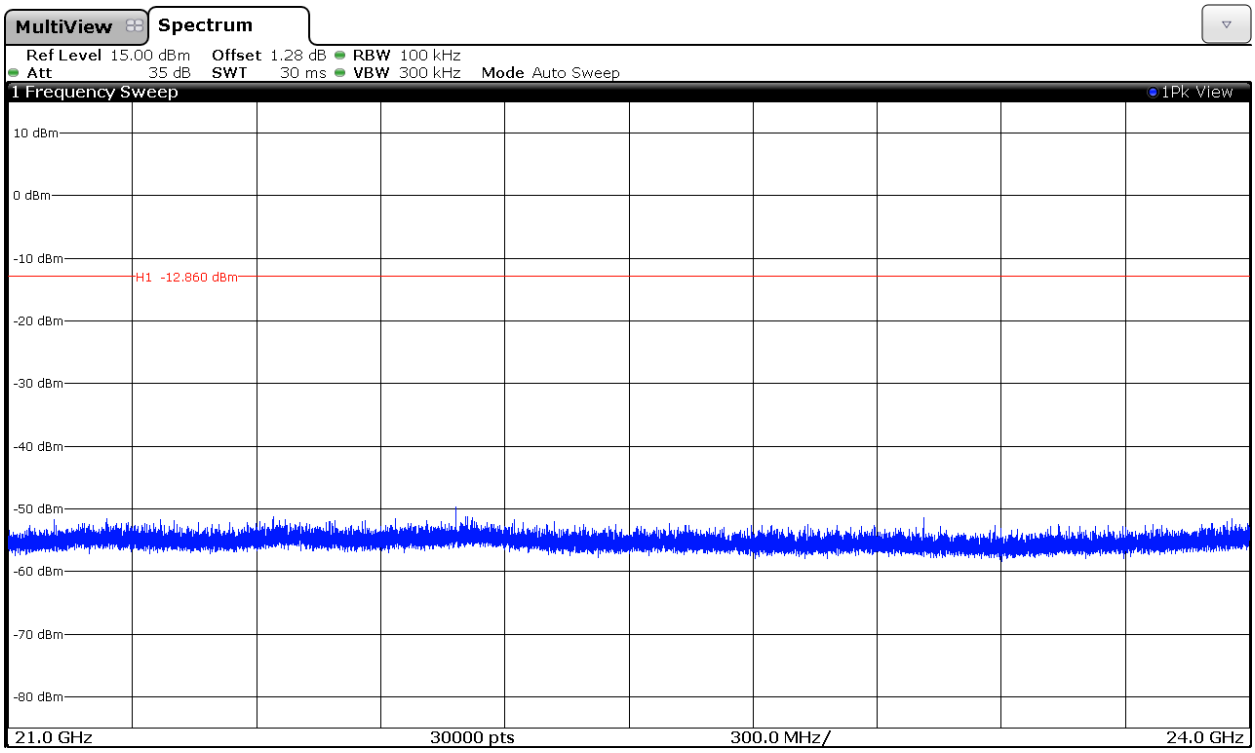
Plot 15 GHz to 18 GHz:



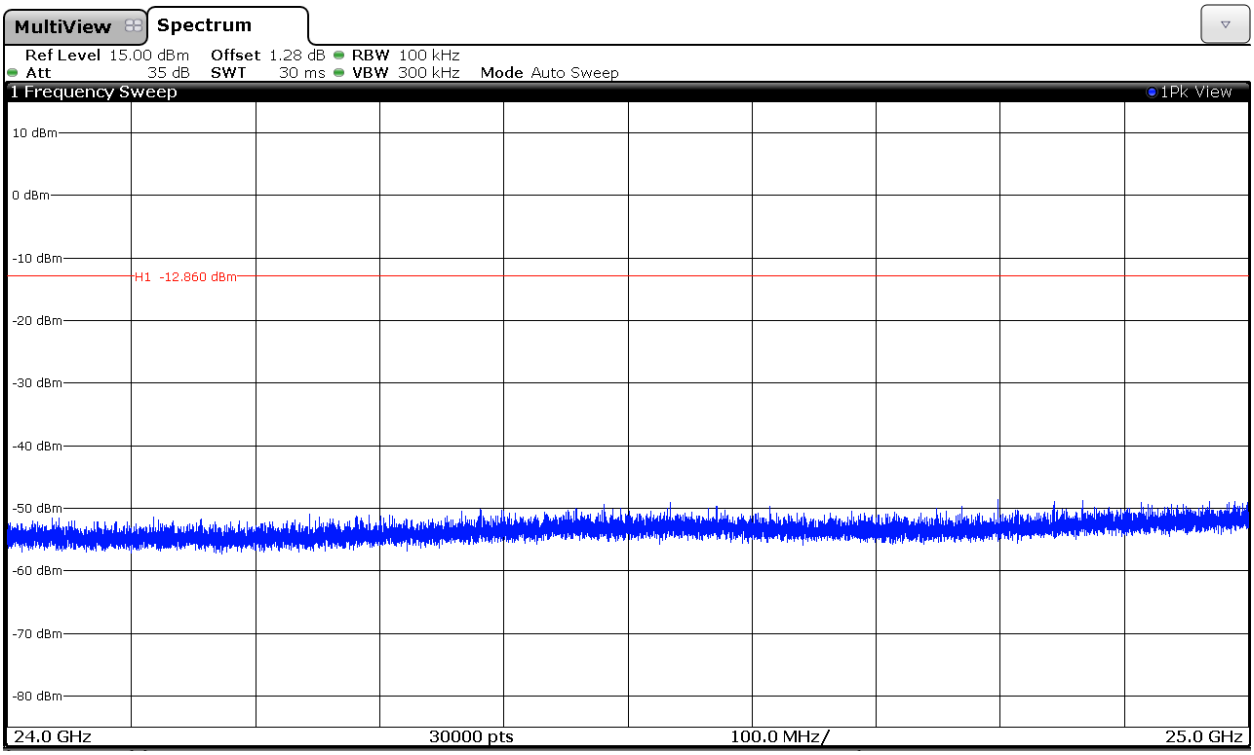
Plot 18 GHz to 21 GHz:



Plot 21 GHz to 24 GHz:



Plot 24GHz to 25 GHz:



4. WiFi 2.4GHz 802.11 n40 mode

Reference Level Measurement

	Lowest frequency 2422 MHz		Middle frequency 2437 MHz		Highest frequency 2452 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Reference Level Measurement (dBm)	-0.34	-0.54	3.70	3.57	-1.41	-1.86
Measurement uncertainty (dB)	±1.5					

Chain A / B:

Lowest frequency 2422 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-30.34 / -30.54

Middle frequency 2437 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-26.30 / -26.43

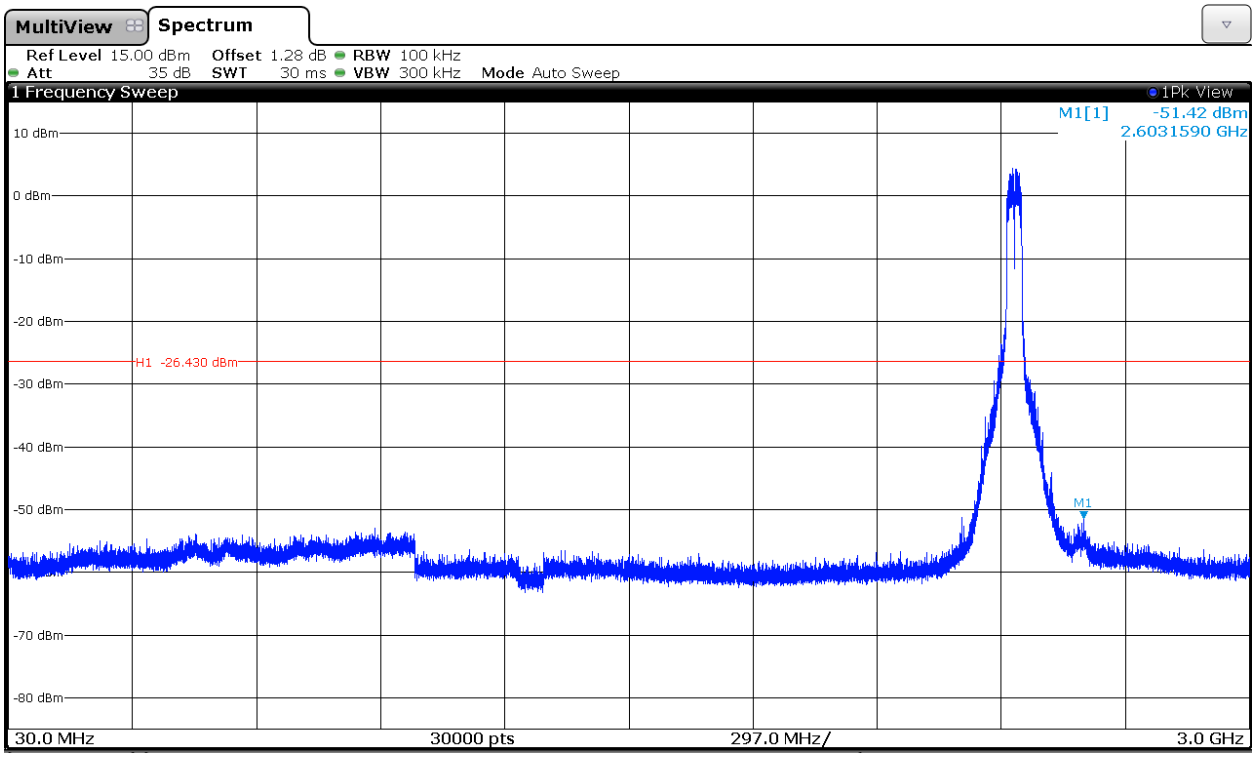
Highest frequency 2452 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-31.41 / -31.86

Verdict: PASS

See next plots of worst case: Mode n40. Middle Channel: 2437 MHz. Chain B.

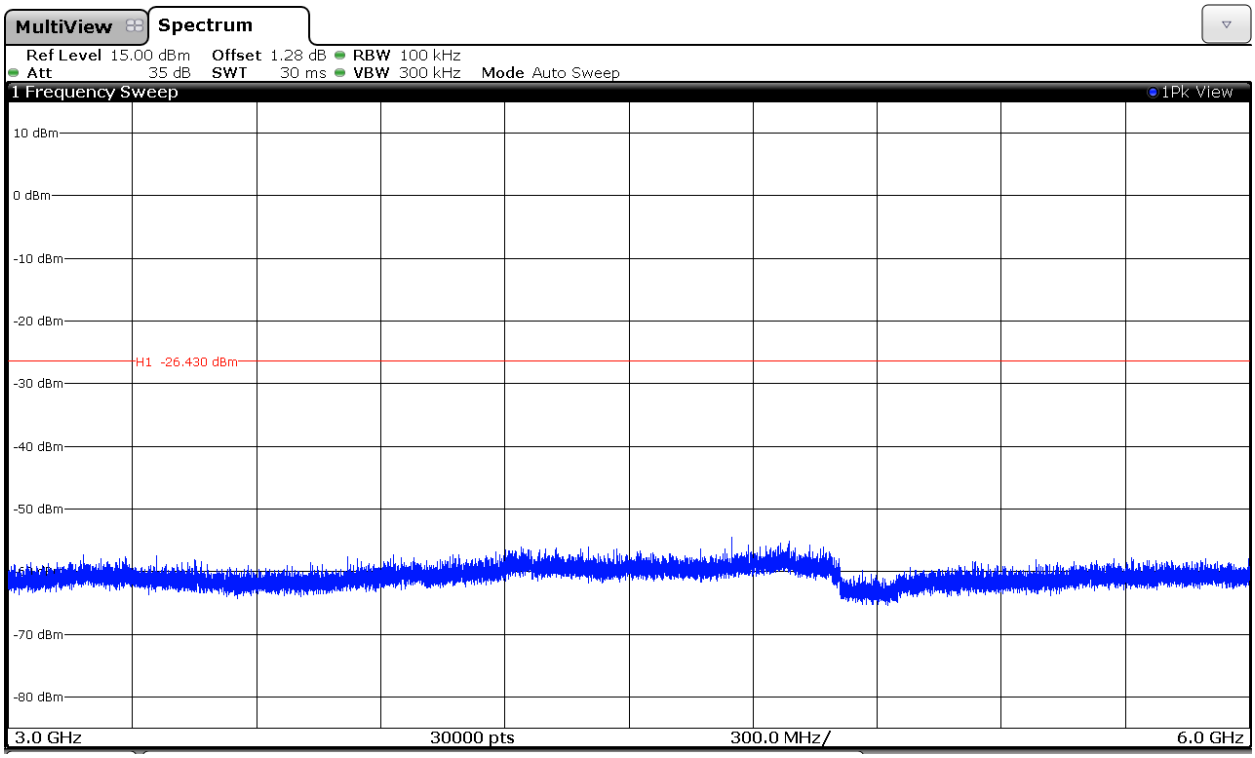
Number of sweep points: 30,000.

Plot 30 MHz to 3 GHz:

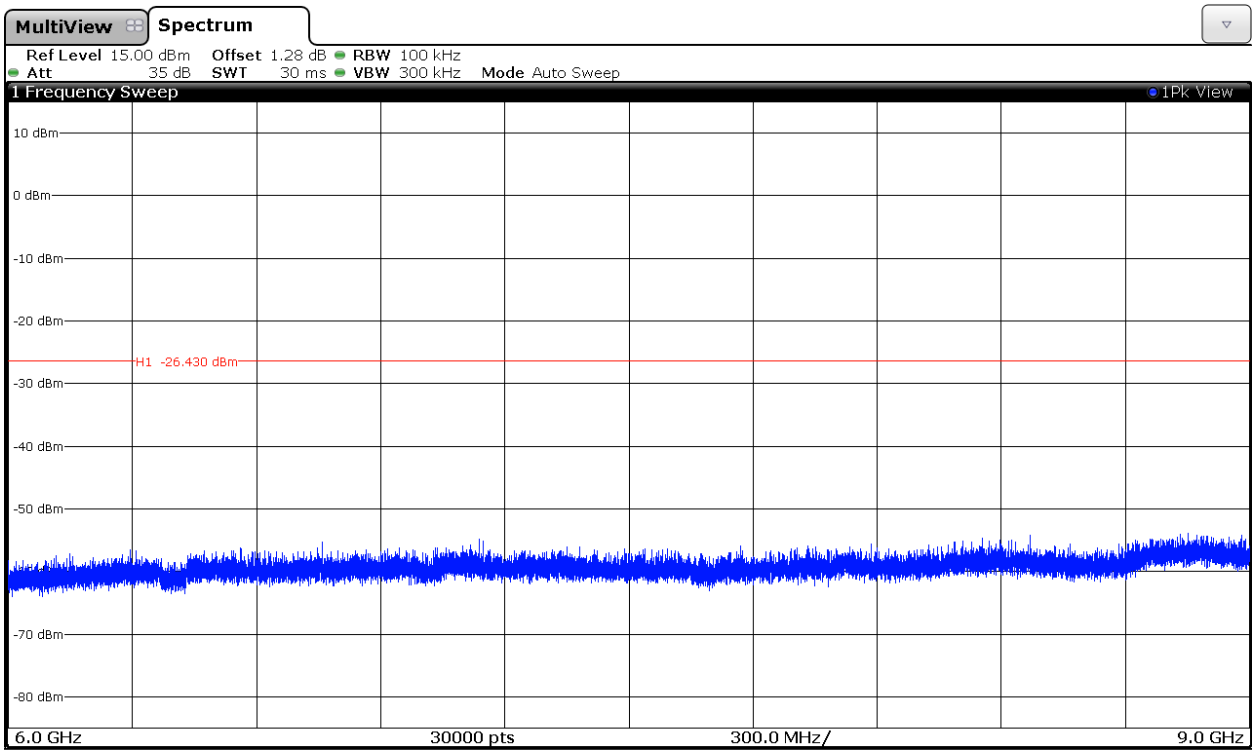


Note: The peak above the limit is the carrier frequency.

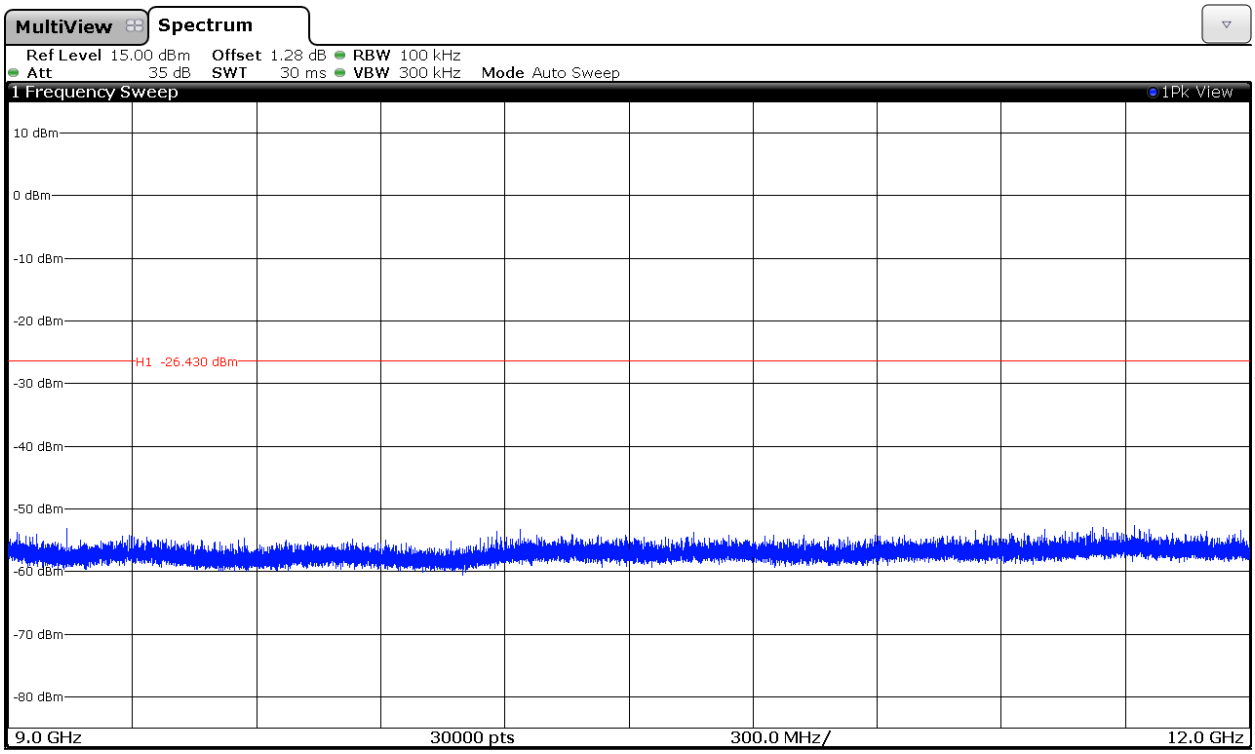
Plot 3 GHz to 6 GHz:



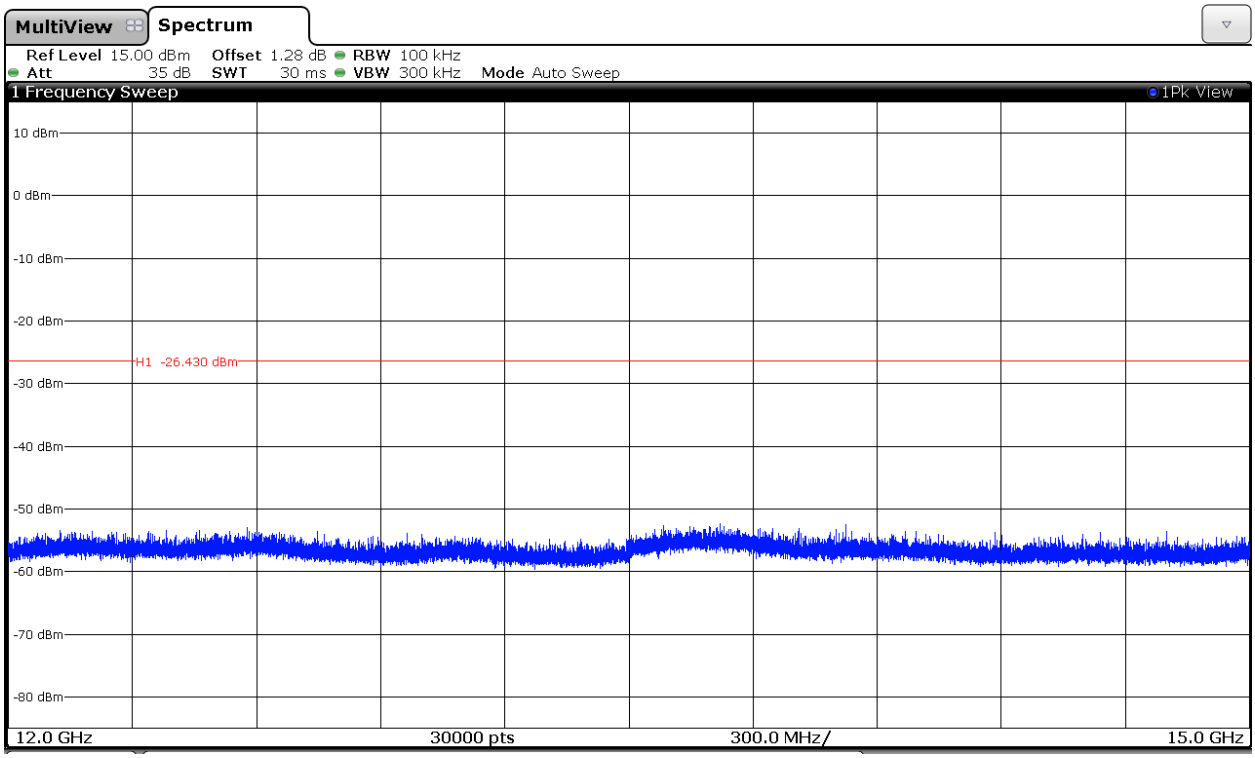
Plot 6 GHz to 9 GHz:



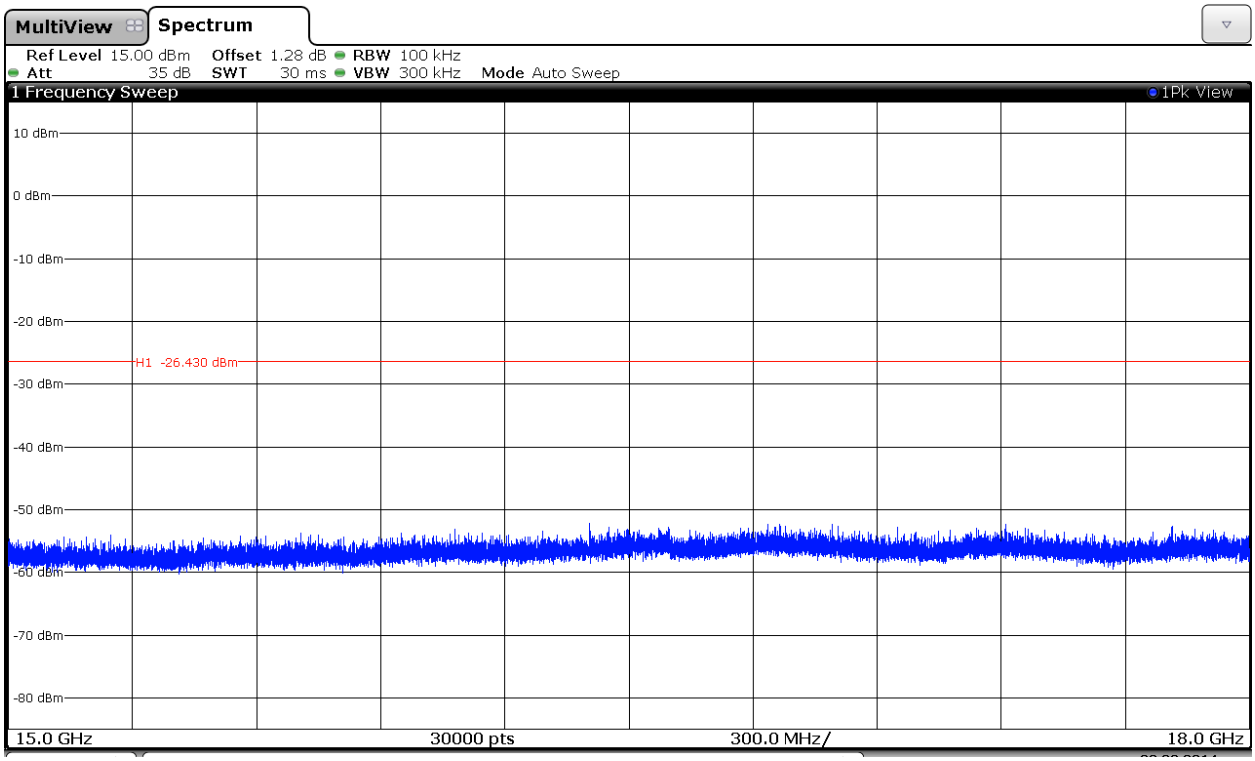
Plot 9 GHz to 12 GHz:



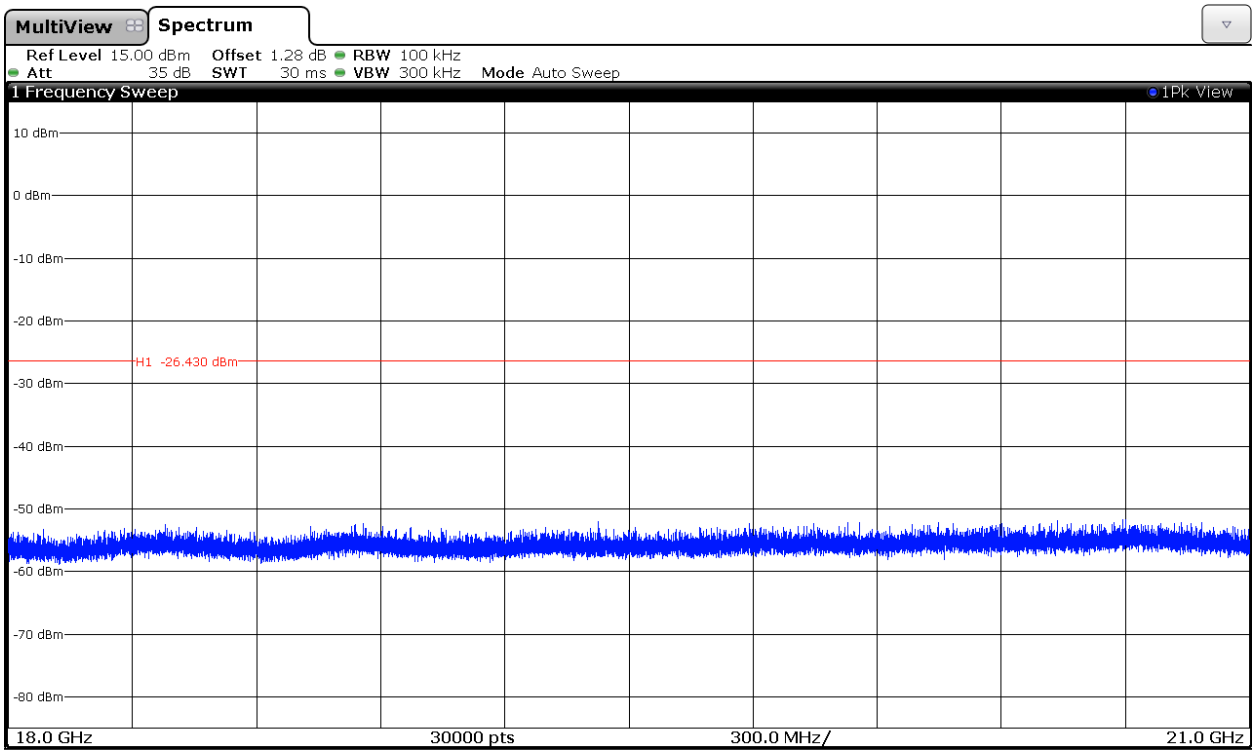
Plot 12 GHz to 15 GHz:



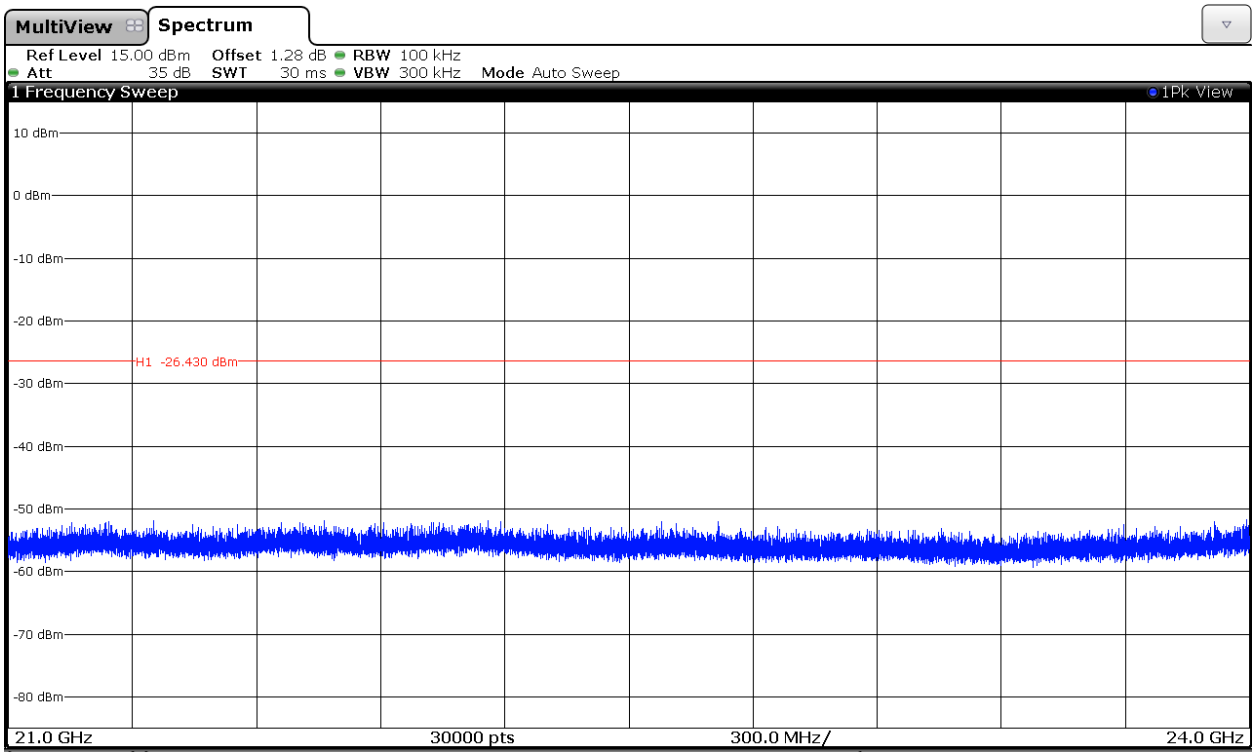
Plot 15 GHz to 18 GHz:



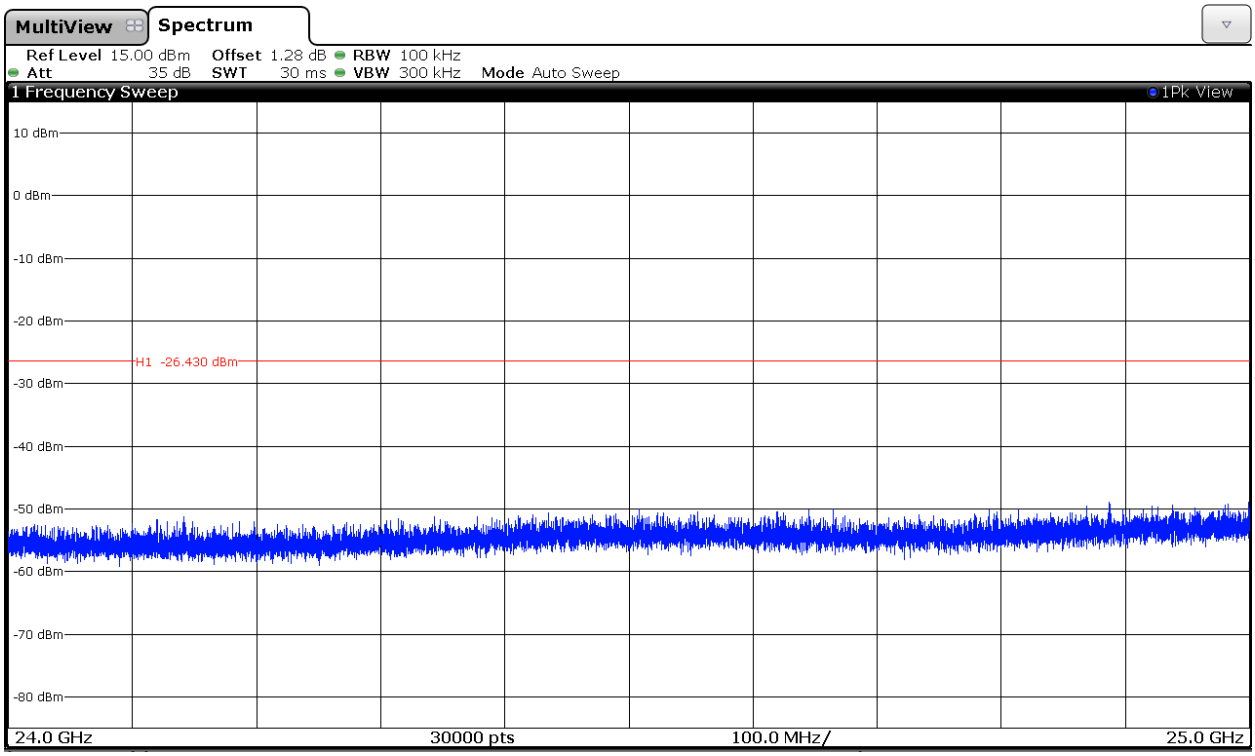
Plot 18 GHz to 21 GHz:



Plot 21 GHz to 24 GHz:



Plot 24GHz to 25 GHz:



Section 15.247 Subclause (d) / RSS-210 A8.5. Band-edge emissions compliance (Transmitter)

SPECIFICATION

Emissions outside the frequency band in which the intentional radiator is operating shall be at least 20dB below the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

RESULTS:

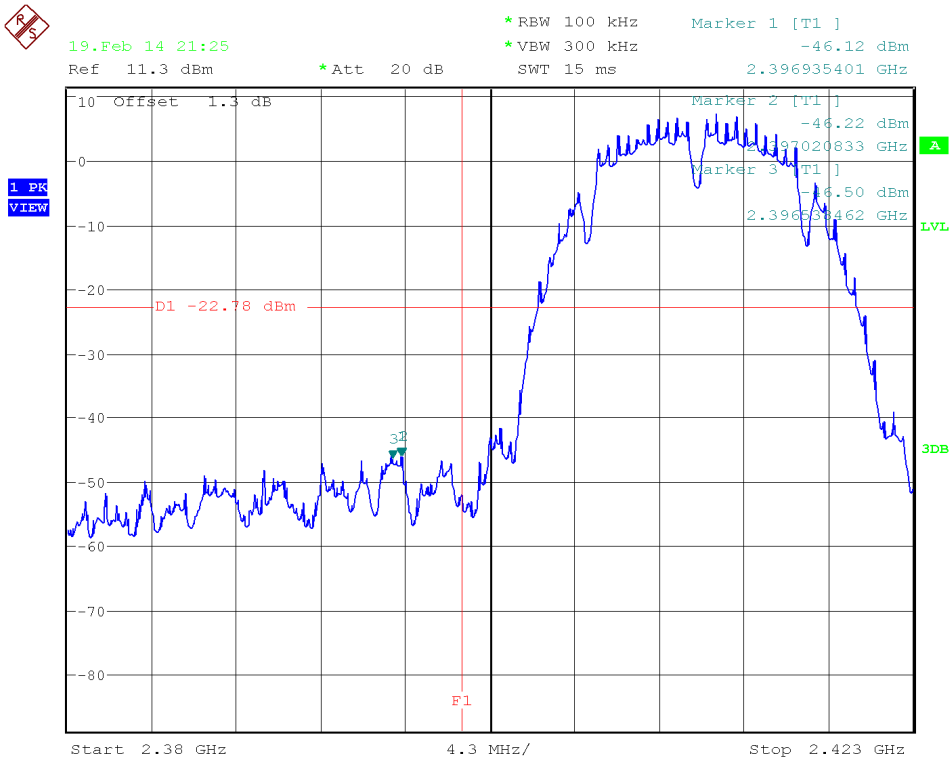
Note: Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

LOW FREQUENCY SECTION 2412 MHz. CONDUCTED.

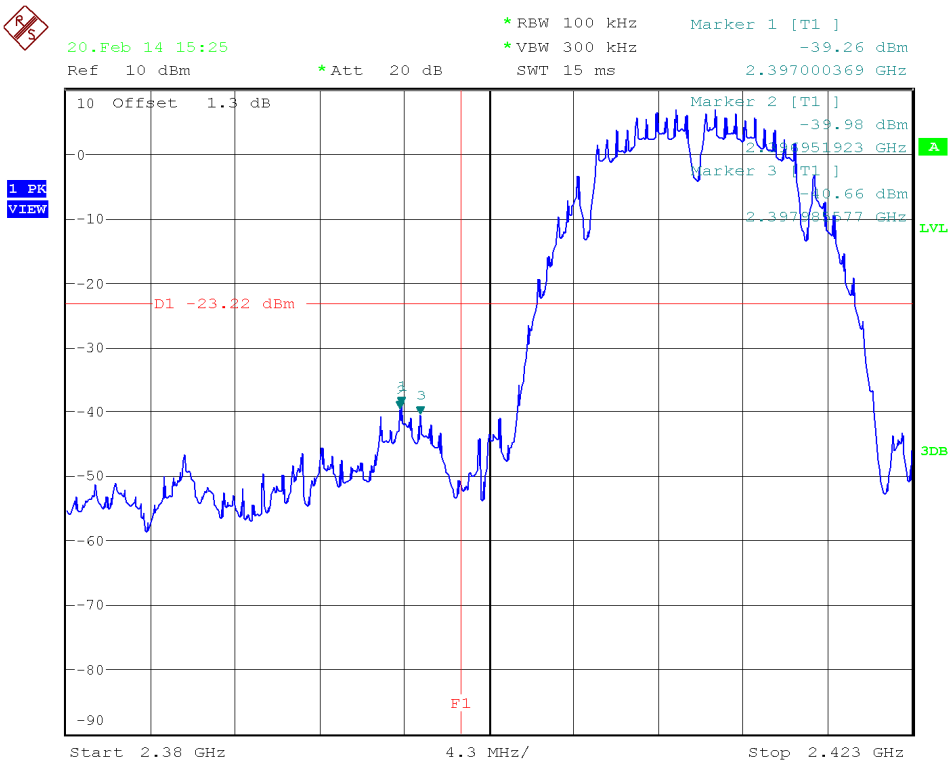
1. WiFi 2.4GHz 802.11 b mode

See next plots.

Chain A



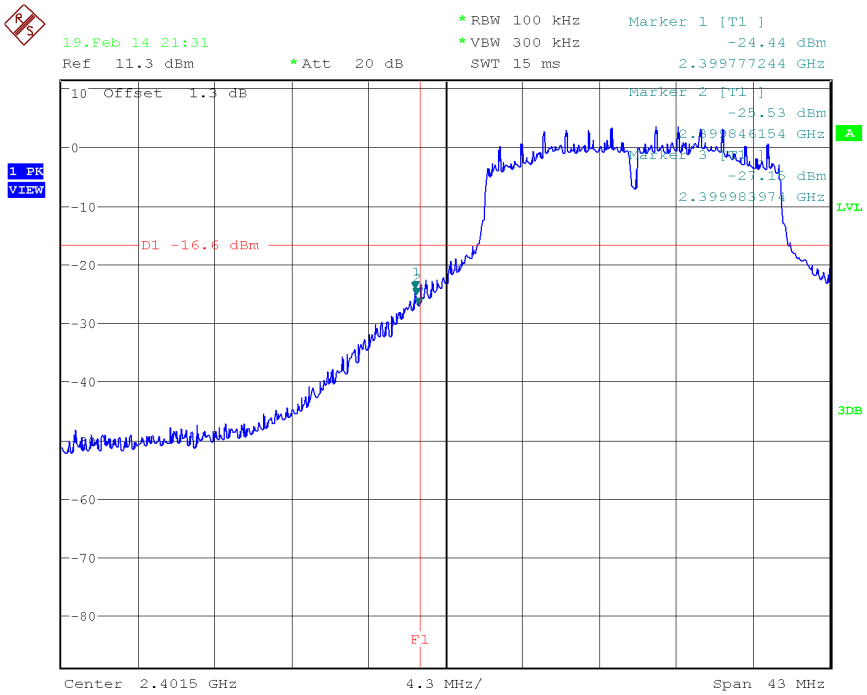
Chain B



Verdict: PASS

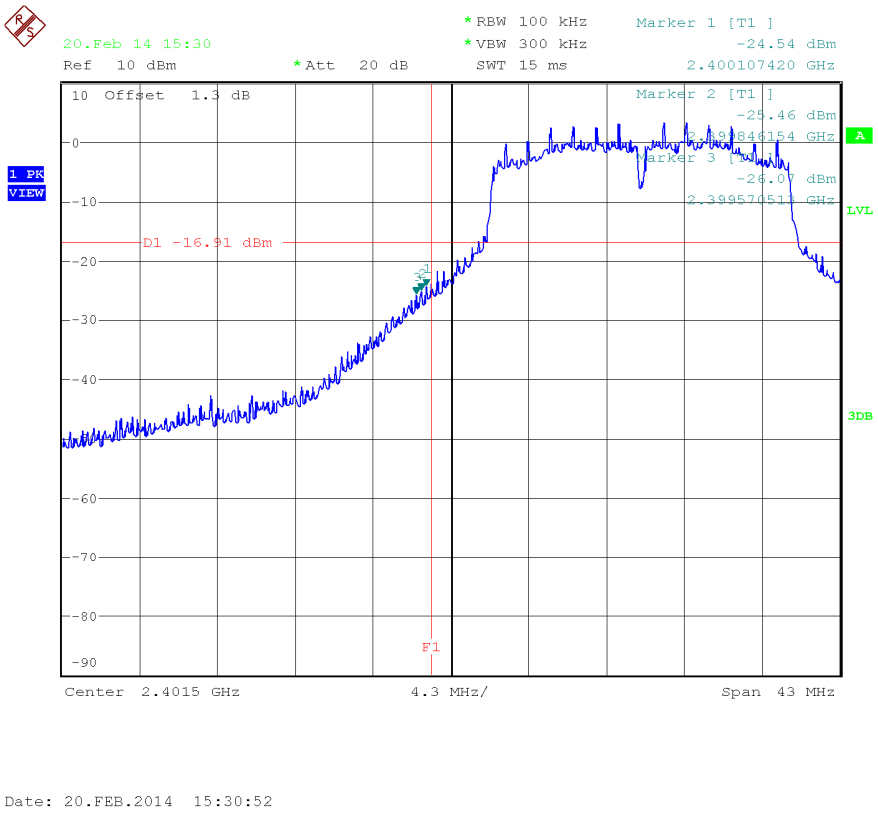
2. WiFi 2.4GHz 802.11 g mode

Chain A



Date: 19.FEB.2014 21:31:34

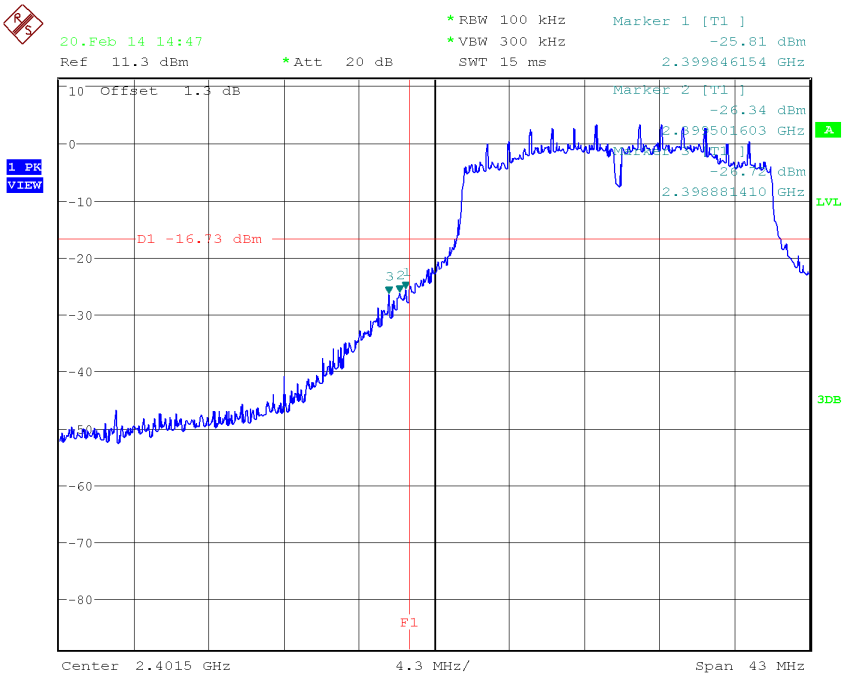
Chain B



Verdict: PASS (NOTE: The limit is set to -20 dBc since the maximum peak conducted output power was measured for this mode.)

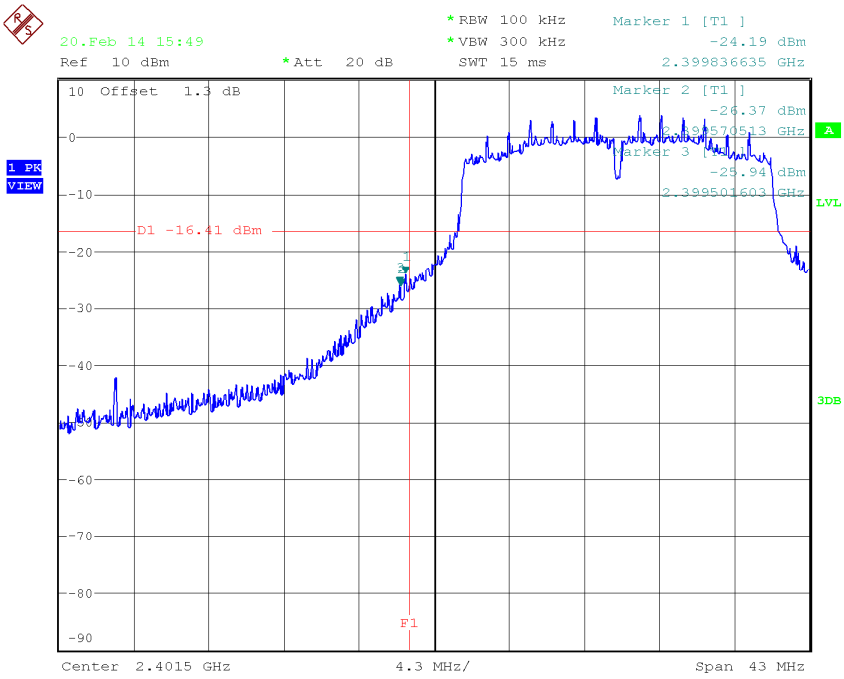
3. WiFi 2.4GHz 802.11 n20 mode

Chain A



Date: 20.FEB.2014 14:47:14

Chain B

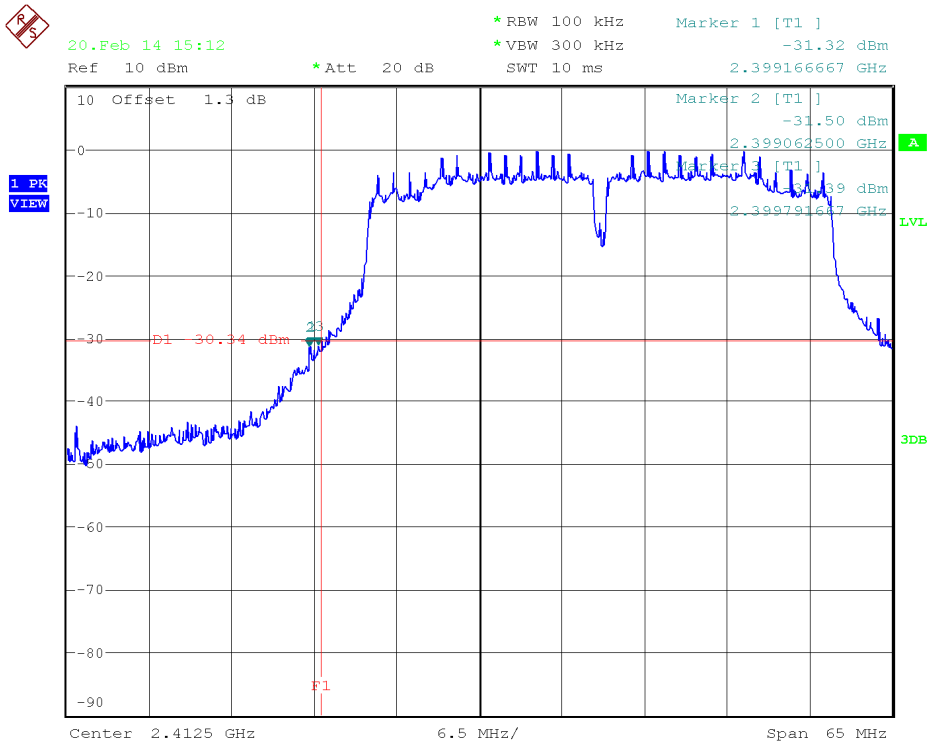


Date: 20.FEB.2014 15:49:54

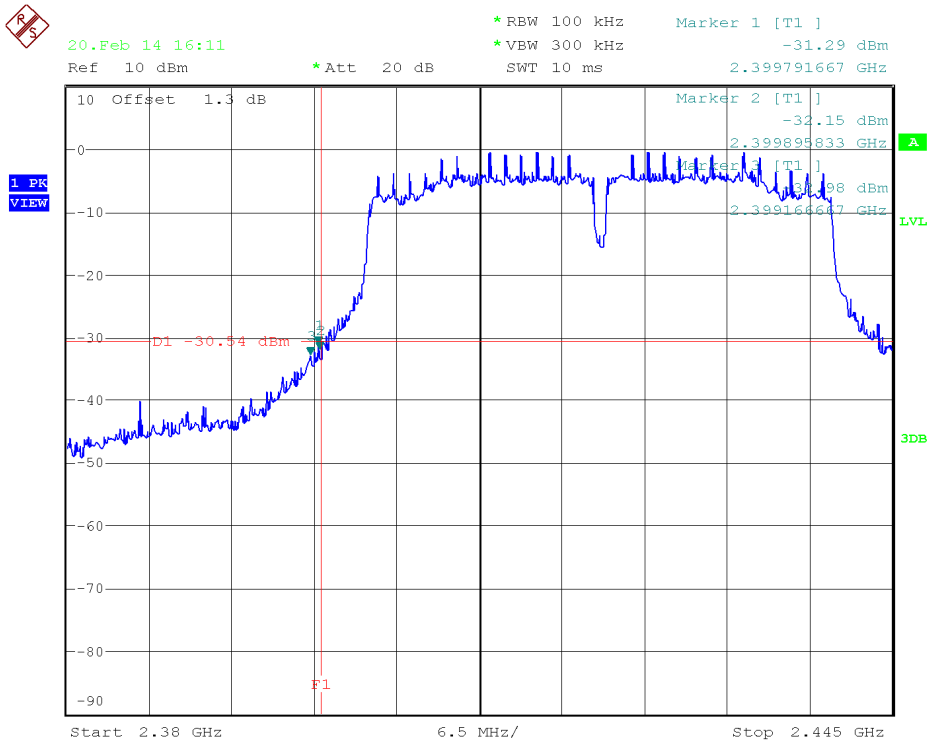
Verdict: PASS (NOTE: The limit is set to -20 dBc since the maximum peak conducted output power was measured for this mode.)

4. WiFi 2.4GHz 802.11 n40 mode

Chain A



Chain B



Verdict: PASS

Section 15.247 Subclause (e) / RSS-210 A8.5. 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 of trace averaging with EUT transmitting at full power throughout each sweep according to point 10.3. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03r01 dated 09/04/2013. This method was used for 802.11b and 802.11n40 modes.
For 802.11g and 802.11n20 modes the PKPSD (peak PSD) method was used since the maximum peak conducted output power was measured for this mode.

For MIMO mode, the *Measure and add 10 log(NANT) dB*, (where *NANT* is the number of outputs) technique was used according to the Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01 dated 10/31/2013.
With this technique, spectrum measurements are performed at each output of the device, and the quantity *10 log(NANT)* dB is added to each spectrum value before comparing to the emission limit.
Number of outputs = 2.

1. WiFi 2.4GHz 802.11 b mode

Power spectral density (See next plot of worst case = highest level).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Power spectral density (dBm)	-0.869	-0.583	0.170	0.266	-0.802	-1.194
Measurement uncertainty (dB)	±1.5					

Verdict: PASS

2. WiFi 2.4GHz 802.11 g mode

Power spectral density (See next plot of worst case = highest level).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Power spectral density (dBm)	3.73	4.33	6.99	7.76	1.99	2.20
Measurement uncertainty (dB)	±1.5					

Verdict: PASS (NOTE: the PKPSD (peak PSD) method was used since the maximum peak conducted output power was measured for this mode).

3. WiFi 2.4GHz 802.11 n20 mode

Power spectral density (See next plot of worst case = highest level).

	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Power spectral density (dBm)	3.77	3.87	6.90	7.54	1.36	1.36
Measurement uncertainty (dB)	±1.5					

MIMO	Lowest frequency 2412 MHz		Middle frequency 2437 MHz		Highest frequency 2462 MHz	
	Chain A+B		Chain A+B		Chain A+B	
	Port A	Port B	Port A	Port B	Port A	Port B
Power spectral density (dBm)	2.62	1.70	-6.92	-6.59	2.25	1.65
Power spectral density (dBm) + 10*Log(2)	5.63	5.26	-3.91	-3.58	5.26	4.66
Measurement uncertainty (dB)	±1.5		±1.2		±1.5	

Verdict: PASS (NOTE: the PKPSD (peak PSD) method was used since the maximum peak conducted output power was measured for this mode. The Middle channel (MIMO A+B) was measured with RBW=3KHz and VBW=30KHz.)

4. WiFi 2.4GHz 802.11 n40 mode

Power spectral density (See next plot of worst case= highest level).

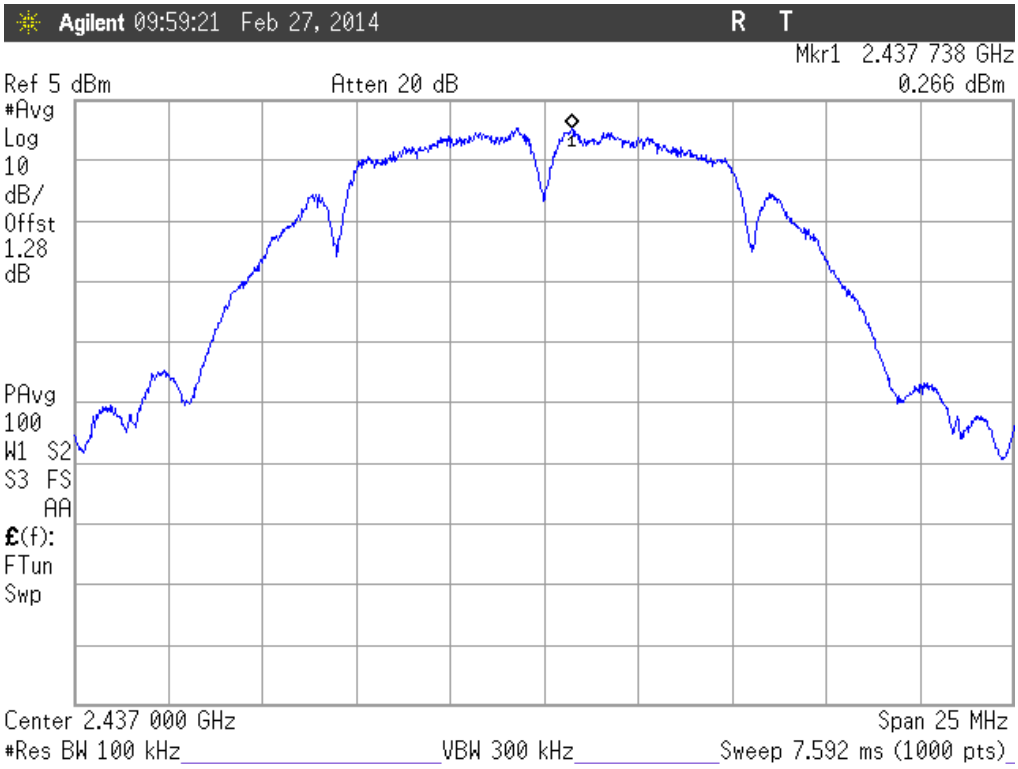
	Lowest frequency 2422 MHz		Middle frequency 2437 MHz		Highest frequency 2452 MHz	
	Chain A	Chain B	Chain A	Chain B	Chain A	Chain B
Power spectral density (dBm)	-9.504	-9.990	-5.311	-5.960	-10.121	-11.653
Measurement uncertainty (dB)	±1.5					

MIMO	Lowest frequency 2422 MHz		Middle frequency 2437 MHz		Highest frequency 2452 MHz	
	Chain A+B		Chain A+B		Chain A+B	
	Port A	Port B	Port A	Port B	Port A	Port B
Power spectral density (dBm)	-13.957	-13.139	-9.599	-9.440	-13.933	-13.726
Power spectral density (dBm) + 10*Log(2)	-10.95	-10.13	-6.59	-6.43	-10.92	-10.72
Measurement uncertainty (dB)	±1.5					

Verdict: PASS

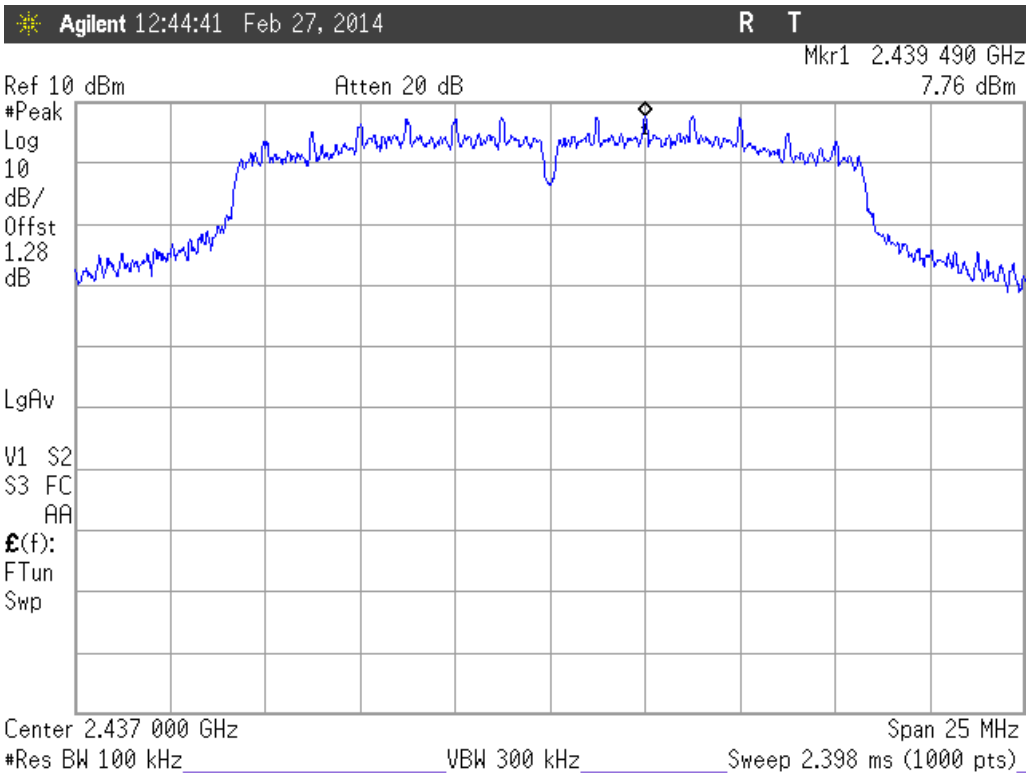
1. WiFi 2.4GHz 802.11 b mode

Middle Channel: 2437 MHz. Chain B.



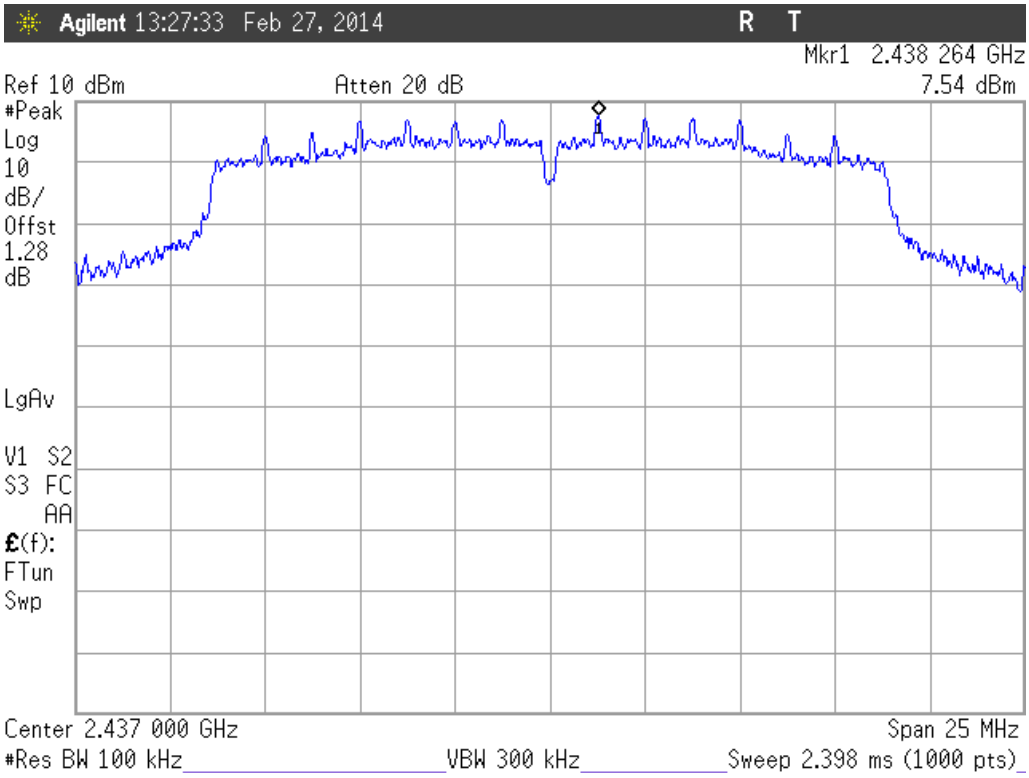
2. WiFi 2.4GHz 802.11 g mode

Middle Channel: 2437 MHz. Chain B.

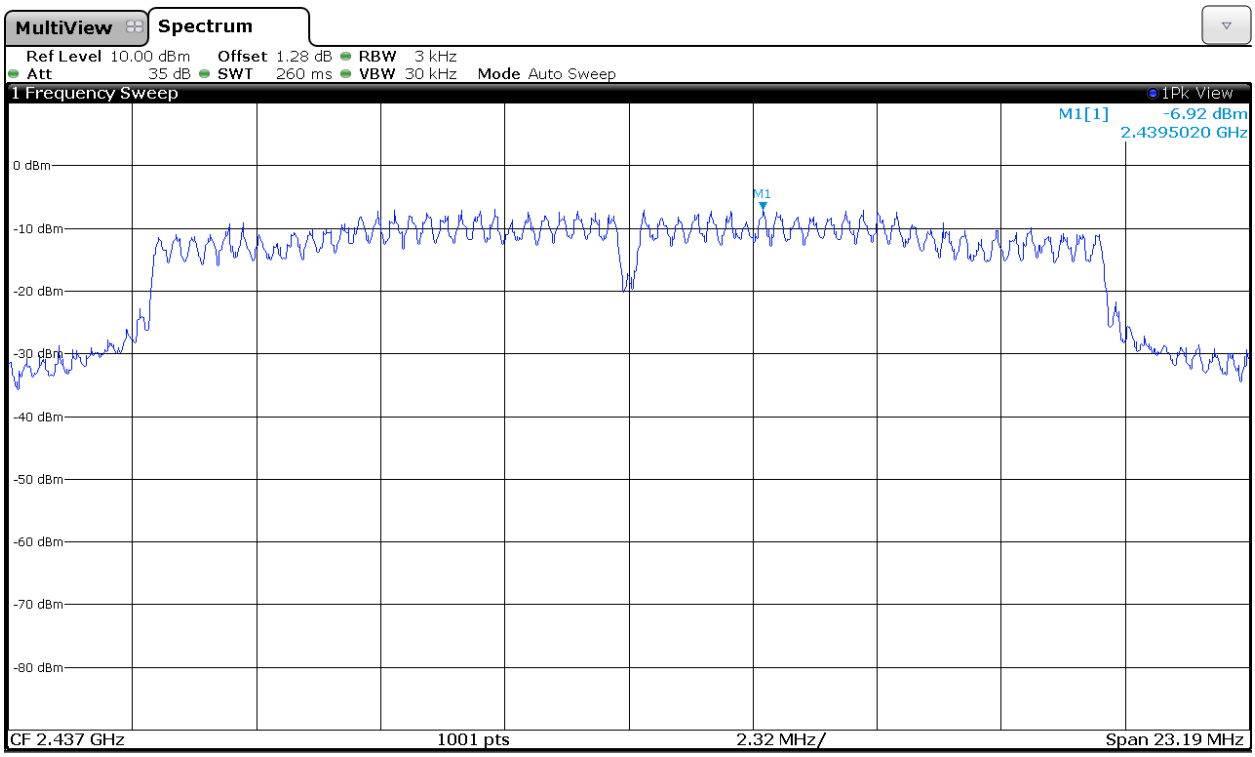


3. WiFi 2.4GHz 802.11 n20 mode

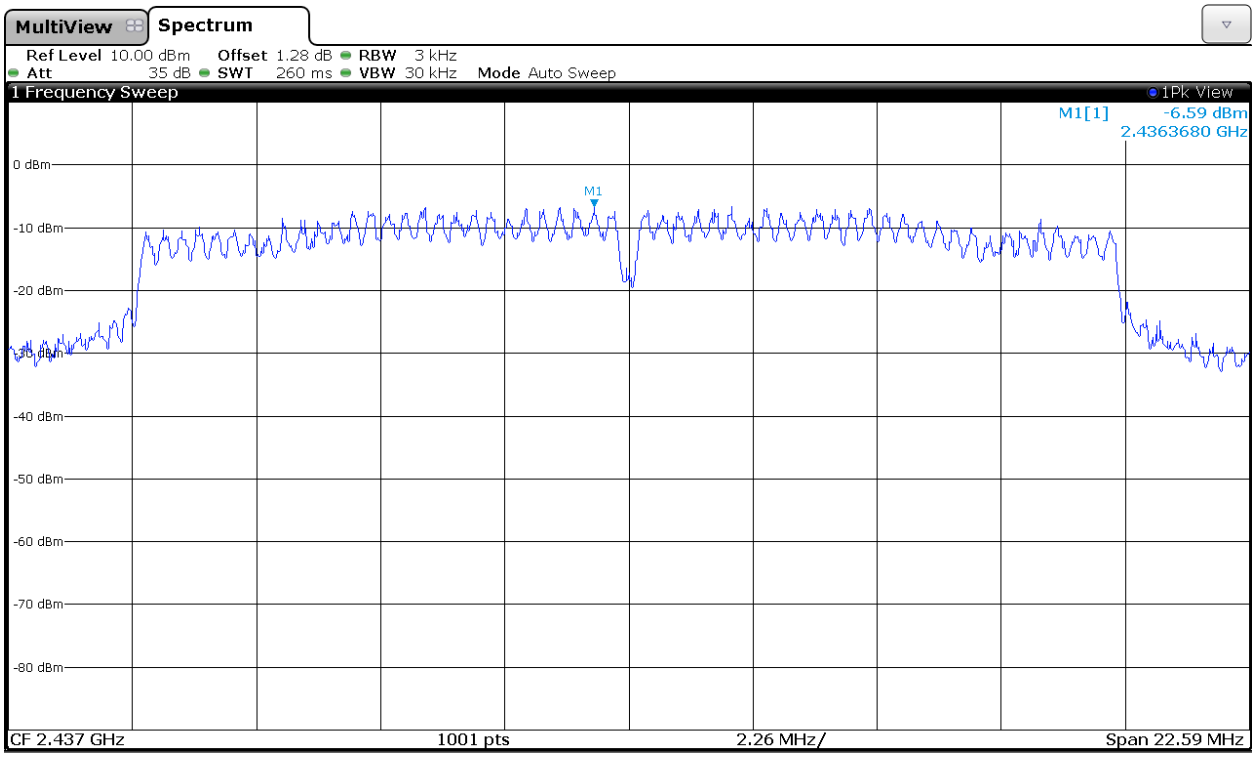
SISO. Middle Channel: 2437 MHz. Chain B.



MIMO. Middle Channel: 2437 MHz. Chain A+B. Port A.

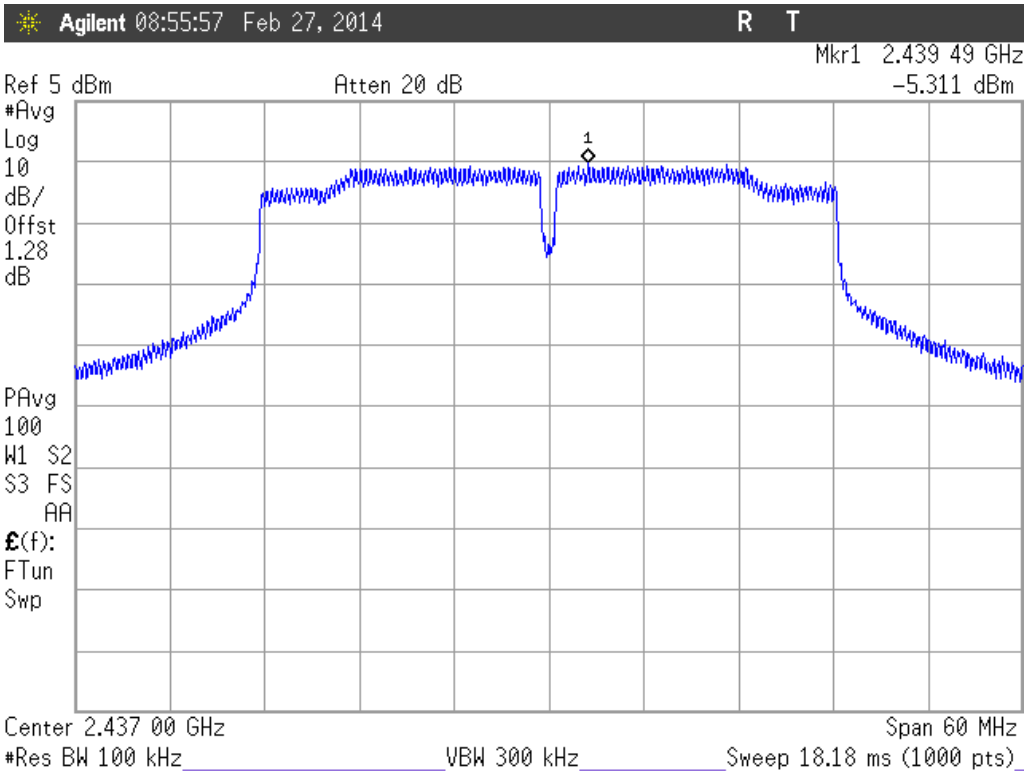


MIMO. Middle Channel: 2437 MHz. Chain A+B. Port B.

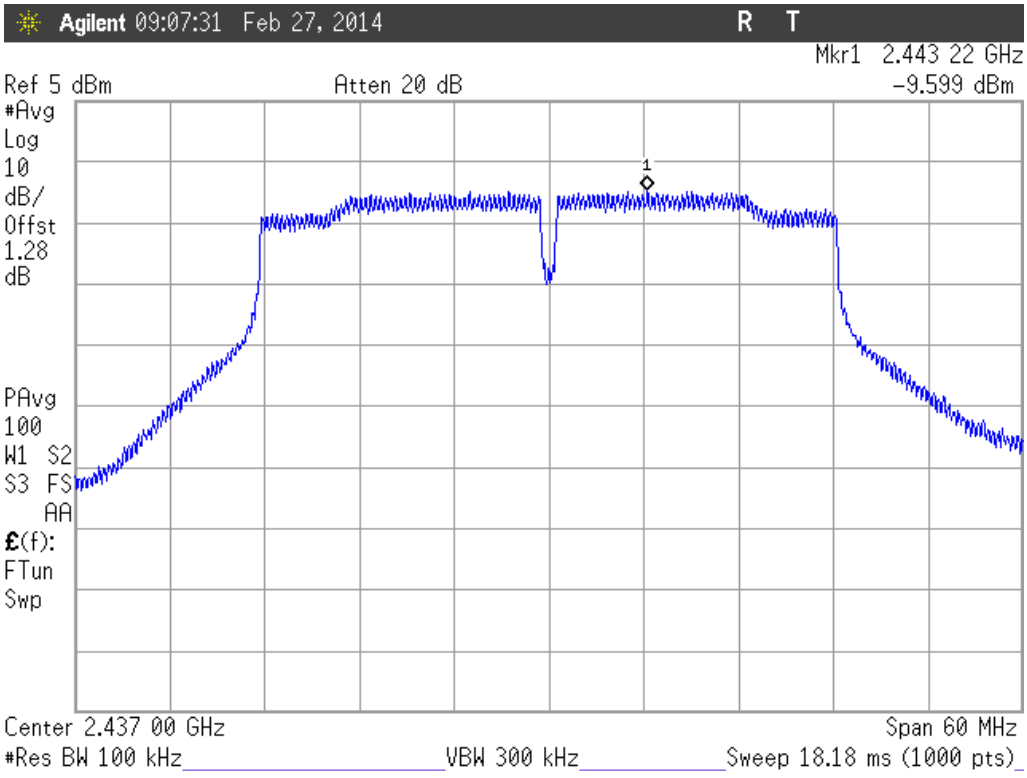


4. WiFi 2.4GHz 802.11 n40 mode

SISO. Middle Channel: 2437 MHz. Chain A.



MIMO. Middle Channel: 2437 MHz. Chain A+B. Port A.



MIMO. Middle Channel: 2437 MHz. Chain A+B. Port B.