

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Wanesy Wave 915

FCC ID: 2AFYS-KLKWAVE915

Company:
KERLINK

Distribution: Mr LOUVEL

(Company: KERLINK)

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DESIGNATION OF PRODUCT: Wanesy Wave 915

Serial number (S/N): 944DBe050009

Reference / model (P/N): PDTIOT-WAV01

Software version: lpiot-refdes-1.5.4

MANUFACTURER: KERLINK

COMPANY SUBMITTING THE PRODUCT:

Company: KERLINK

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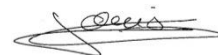
Responsible: Mr LOUVEL

DATE(S) OF TEST: From 2-Dec-19 to 5-Dec-19

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

TESTED BY: S. LOUIS

VISA:



WRITTEN BY: S. LOUIS

CONTENTS

<i>TITLE</i>	<i>PAGE</i>
1. INTRODUCTION	4
2. PRODUCT DESCRIPTION	4
3. NORMATIVE REFERENCE	5
4. TEST METHODOLOGY	5
5. TEST EQUIPMENT CALIBRATION DATES	6
6. TESTS RESULTS SUMMARY	8
7. MEASUREMENT UNCERTAINTY	9
8. CONDUCTED LIMITS	10
9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS	15
10. MAXIMUM CONDUCTED (AVERAGE) OUTPUT POWER	24
11. INTENTIONAL RADIATOR	29
12. MAXIMUM CONDUCTED POWER DENSITY	39
APPENDIX 1 TEST EQUIPMENT LIST	45
APPENDIX 2: 6 DB BANDWIDTH	49
APPENDIX 3: 99% BANDWIDTH	61
APPENDIX 4: RADIATED SPECTRAL DENSITY	73

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **Wanesy Wave 915**, in accordance with normative reference.

The device under test integrates:

- LoRa Hybrid and DTS mode
- BLE and Wi-Fi Radio module

This report concerns only WiFi radio part.

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Residential
Antenna type and gain:	2.15 dBi / integral antenna
Operating frequency range:	From 2400 MHz to 2483.5 MHz
Frequency tested:	2412 MHz, 2437 MHz and 2462 MHz (for 20 MHz) 2422 MHz, 2437 MHz and 2452 MHz (for 40 MHz)
Channel spacing:	5MHz
Power Setting:	atten: 27x0.25
Modulation:	DBPSK OFDM: BPSK OFDM: 64-QAM
Mode tested:	802.11 b 802.11 g 802.11 n (20MHz and 40MHz)
Data rate:	For 802.11b: 1Mbit/s For 802.11g: 6Mbit/s For 802.11n: MCS0
Number of channels:	11 for bandwidth 20 MHz and 7 for bandwidth 40 MHz
Power source:	120VAC / 60Hz

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.

They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 FCC Part 15 (2019) Radio Frequency Devices

ANSI C63.10 2013
Procedures for Compliance Testing of Unlicensed Wireless Devices.

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart C – Intentional Radiators

- Paragraph 203: Antenna requirement
- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements
- Paragraph 212: Modular transmitter
- Paragraph 215: Additional provisions to the general radiated emission limitations
- Paragraph 247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
0	BAT-EMC V3.17.0.25	Software	/	/	/
1406	EMCO 6502	Loop antenna	17/04/2019	1	16/04/2020
4087	Filtek LP03/1000-7GH	Low Pass Filter	29/03/2018	2	28/03/2020
4088	R&S FSP40	Spectrum Analyzer	21/02/2018	2	21/02/2020
6884	Suhner 1.5m	Cable	29/03/2018	2	28/03/2020
7011	California instruments 1251RP	Power source	23/01/2019	1	23/01/2020
7124	A.H. Systems SAS-572	Antenna	04/01/2019	3	03/01/2022
7240	Emco 3110	Biconical antenna	08/03/2019	3	07/03/2022
7299	Microtronics BRM50702	Reject band filter	03/09/2019	2	02/09/2021
7566	Testo 608-H1	Meteo station	24/09/2018	2	23/09/2020
8511	HP 8447D	Low-noise amplifier	14/03/2019	1	13/03/2020
8535	EMCO 3115	Antenna	10/02/2017	3	10/02/2020
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	16/08/2018	3	15/08/2021
8549	Midwest Microwave 20dB	Attenuator	20/03/2019	2	19/03/2021
8590	RG214 N-5m	Cable	29/03/2018	2	28/03/2020
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High-pass filter	01/08/2018	2	31/07/2020
8702	R&S NRVS	Power meter	11/04/2018	2	10/04/2020
8704	LUCIX Corp S180265L3201 LNA	Low-noise amplifier	17/09/2019	1	16/09/2020
8719	Thurbly Thandar Instruments 1600	LISN	14/02/2018	2	14/02/2020
8742	R&S NRV-Z52	Sensor	11/04/2018	2	10/04/2020
8749	La Crosse Technology WS-9232	Meteo station	12/11/2018	2	11/11/2020
8750	La Crosse Technology WS-9232	Meteo station	24/09/2018	2	23/09/2020
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
8974	STORM MICROWAE k-20cm	cable	14/11/2019	2	13/11/2021
8975	STORM MICROWAE k-20cm	cable	14/11/2019	2	13/11/2021

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
9398	N-1.5m	cable	29/03/2018	2	28/03/2020
10651	Absorber sheath current	Emitech	30/03/2018	2	29/03/2020
10730	Mini-circuit ZFL-1000LN	Low-noise amplifier	14/03/2019	1	13/03/2020
10759	SIDT Cage 3	Anechoic chamber	/	/	/
10771	EMCO 3117	Antenna	28/11/2019	3	27/11/2022
10788	Emitech	Outside room Hors cage	/	/	/
10789	MATURO	Turntable and mat controller NCD	/	/	/
12590	LUCIX Corp S005180M3201	Low-noise amplifier	02/09/2019	1	01/09/2020
12911	Huber + Suhner N-2m	cable	29/03/2018	2	28/03/2020
12912	Huber + Suhner N-5m	cable	29/03/2018	2	28/03/2020
14302	SUCOFLEX N-1m	cable	14/12/2018	2	13/12/2020
14303	SUCOFLEX N-2m	cable	14/12/2018	2	13/12/2020
14304	SUCOFLEX N-2.5m	cable	14/12/2018	2	13/12/2020
14736	MATURO	Turntable and mat controller MCU	/	/	/
14831	Fluke 177	Multimeter	12/01/2018	2	12/01/2020
14903	Fluke 177	Multimeter	28/02/2018	2	28/02/2020
15666	R&S FSV40	Spectrum Analyzer	19/07/2018	2	18/07/2020
15812	COMP-POWER PAM-118A	Low-noise amplifier 18GHz	03/09/2019	1	02/09/2020
15882	SUCOFLEX	cable N 5m	27/11/2018	2	26/11/2020

6. TESTS RESULTS SUMMARY

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAP	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				Note 1
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS	X				
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 2
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				Note 3
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) Hopping systems			X		
	(a) (2) Digital modulation techniques	X				Note 4
	(b) Maximum peak output power	X				
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density	X				
	(f) Hybrid system			X		
	(g) Frequency hopping requirements			X		
	(h) Frequency hopping intelligence			X		
	(i) RF exposure compliance	X				

NAP: Not Applicable

NAs: Not Asked

Note 1: Integral antenna without standard connector.

Note 2: See FCC part 15.247 (d).

Note 3: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

Note 4: The minimum 6 dB bandwidth of the equipment is 10.12 MHz (see appendix 2).

7. MEASUREMENT UNCERTAINTY

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for normal distribution corresponds to a coverage probability of approximately 95%.

Parameter	Emitech Uncertainty
RF power, conducted	$\pm 0.75\text{dB}$
Radiated emission valid to 26 GHz	
F < 62.5 MHz:	$\pm 5.14\text{ dB}$
62.5 MHz < F < 1 GHz:	$\pm 5.13\text{ dB}$
1 GHz < F < 26 GHz:	$\pm 5.16\text{ dB}$
AC Power Lines conducted emissions	$\pm 3.38\text{ dB}$
Temperature	$\pm 1\text{ }^{\circ}\text{C}$
Humidity	$\pm 5\text{ \%}$

8. CONDUCTED LIMITS**Temperature (°C) :** 23**Humidity (%HR):** 41**Date :** December 5, 2019**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** Paragraph 15.207**Software used:** BAT-EMC V3.17.0.25**Test set up:**

The EUT is isolated and placed on a wooden table, 0.8 m over an horizontal reference plane and 0.4 m from a vertical reference plane. It is powered by an artificial main network placed on the ground reference plane. The equipment is powered with the AC power operating voltage of 120 V / 60 Hz.

Frequency range: 150 kHz - 30 MHz**Detection mode:** Peak / Quasi-peak / Average**Bandwidth:** 10 kHz / 9 kHz**Equipment under test operating condition:**

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

4 configurations were tested:

- 802.11.b with bandwidth of 20MHz – Channel 1
- 802.11.g with bandwidth of 20MHz – Channel 1
- 802.11.n with bandwidth of 20MHz – Channel 1
- 802.11.n with bandwidth of 40MHz – Channel 3

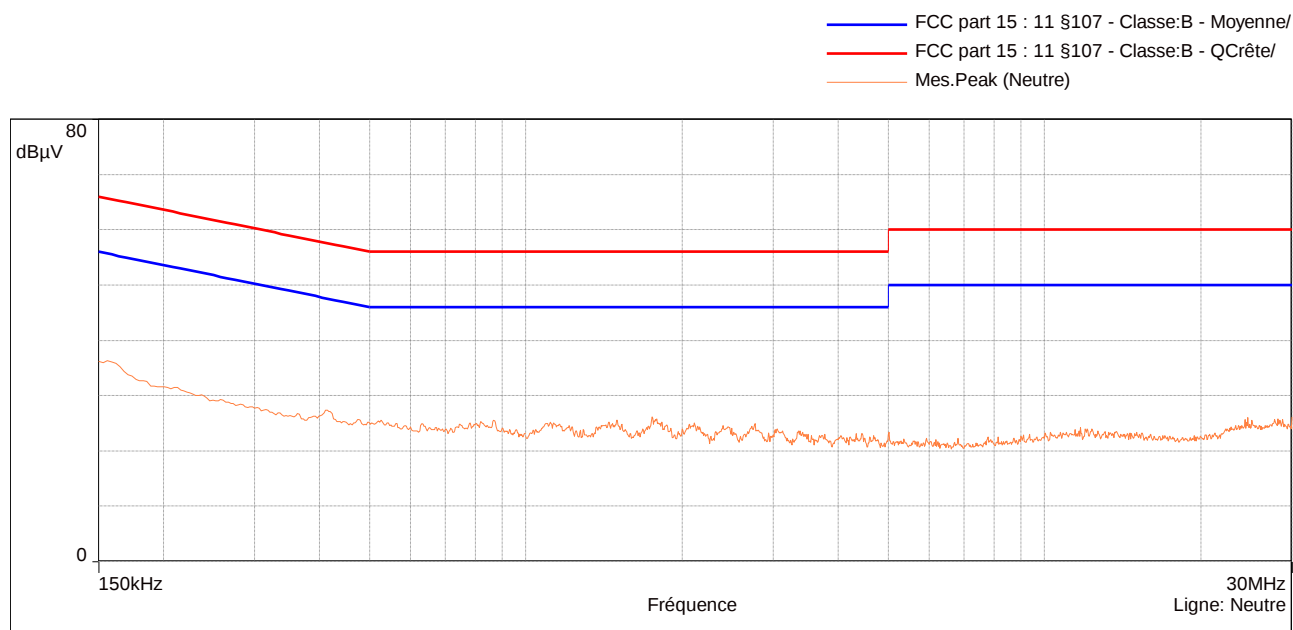
Results: WiFi 802.11.b with bandwidth of 20MHz

Sample N° 1:

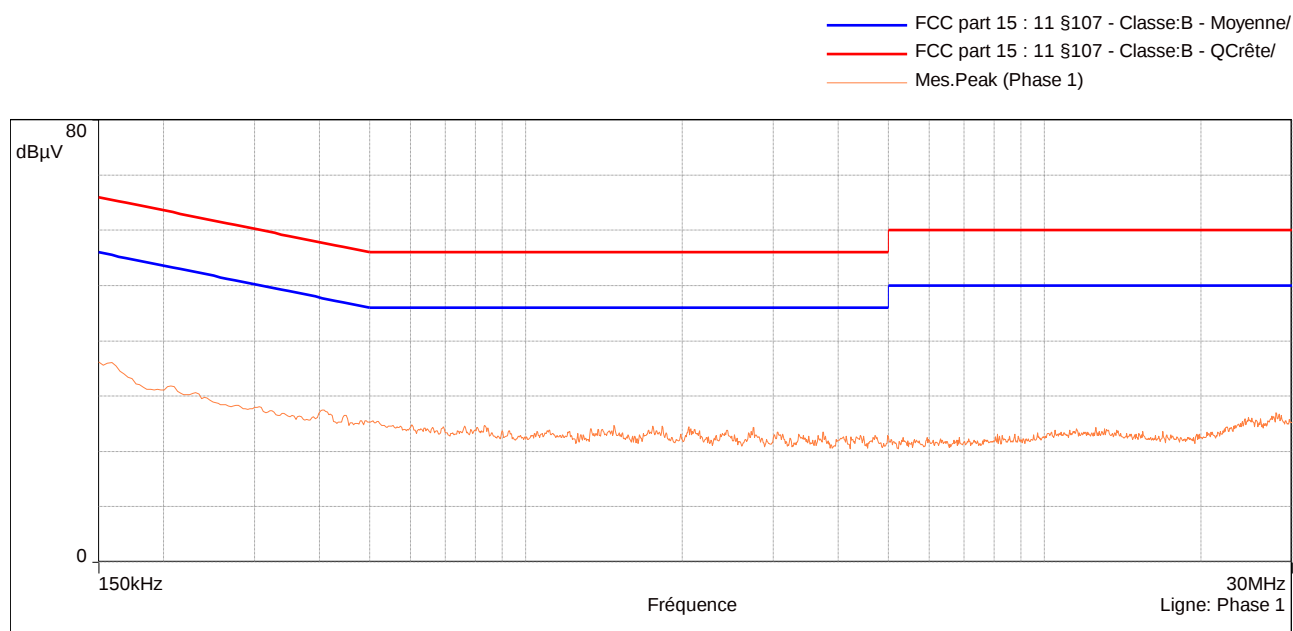
Measurement on the mains power supply:

The measurement is first realized with peak detector.

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



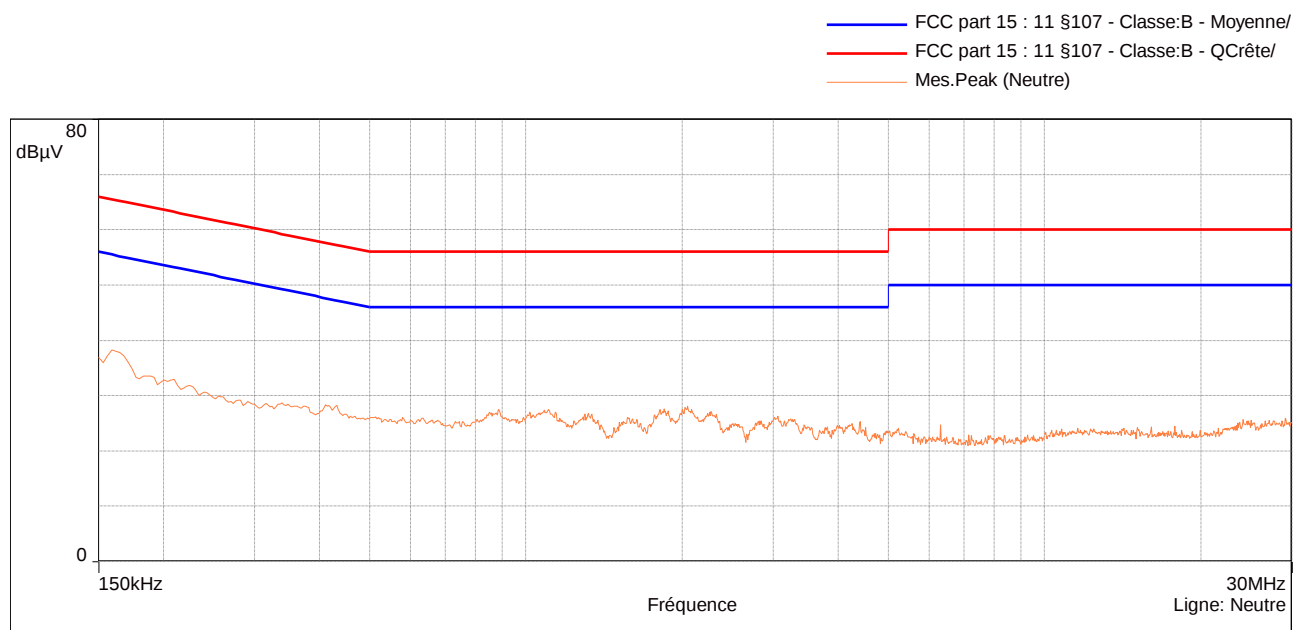
Results: WiFi 802.11.g with bandwidth of 20MHz

Sample N° 1:

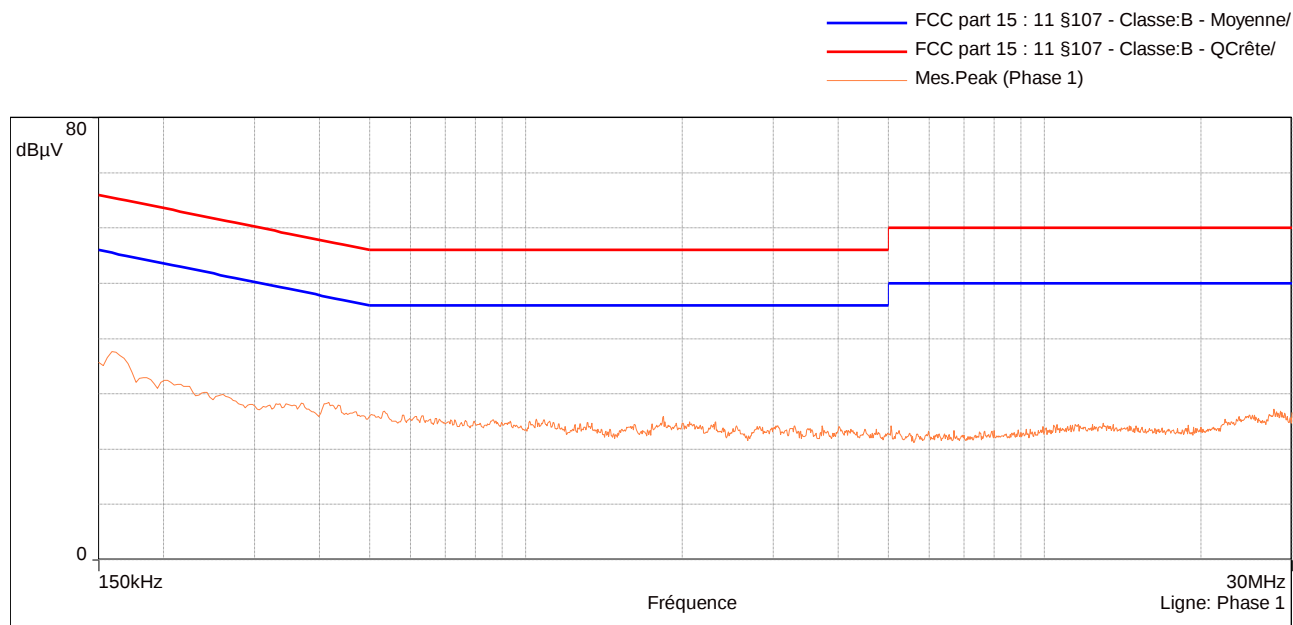
Measurement on the mains power supply:

The measurement is first realized with peak detector.

Curve N° 3: measurement on the Neutral with peak detector



Curve N° 4: measurement on the Line with peak detector



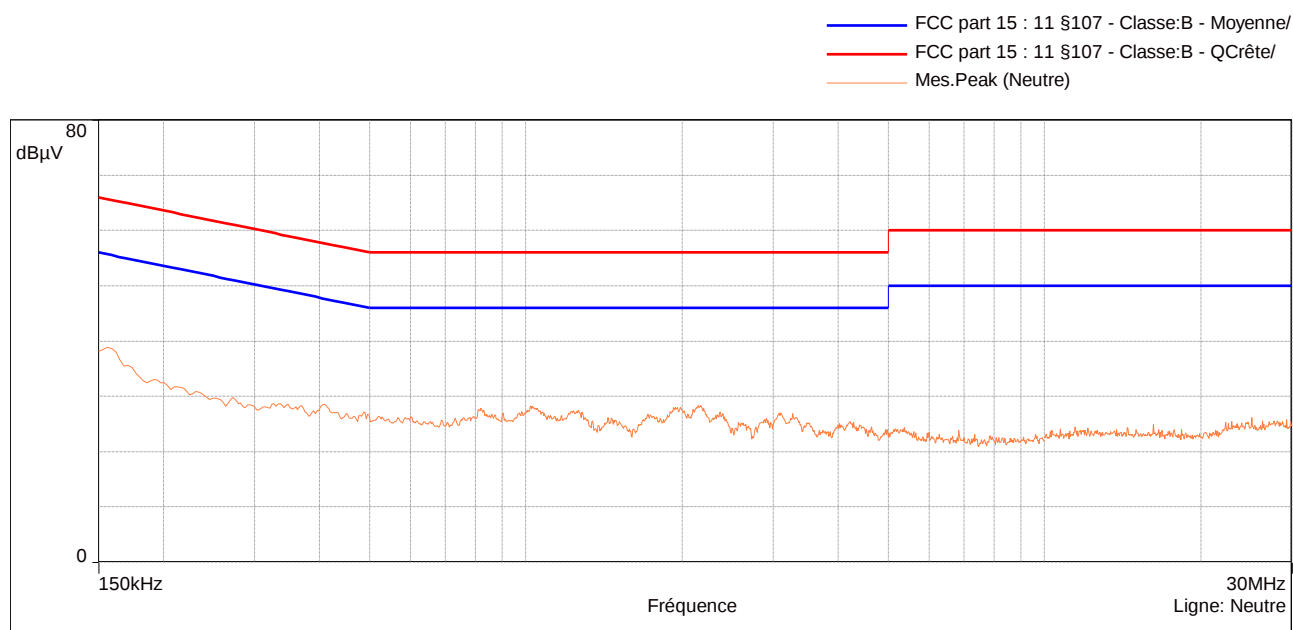
Results: WiFi 802.11.n with bandwidth of 20MHz

Sample N° 1:

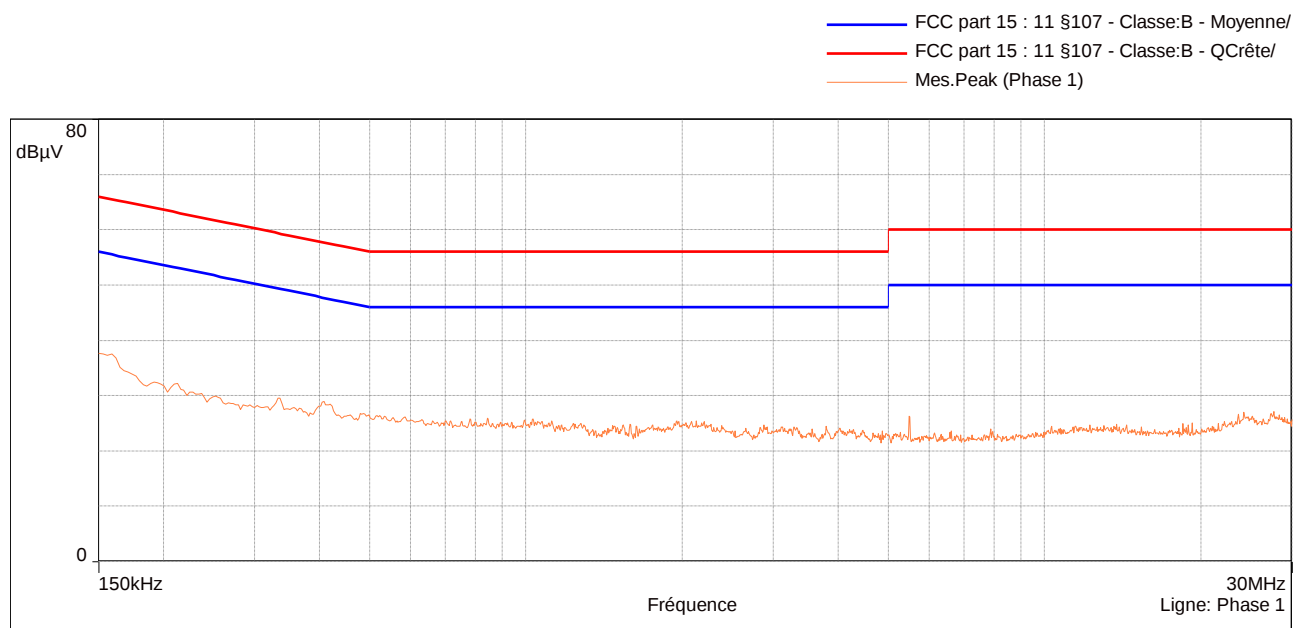
Measurement on the mains power supply:

The measurement is first realized with peak detector.

Curve N° 5: measurement on the Neutral with peak detector



Curve N° 6: measurement on the Line with peak detector



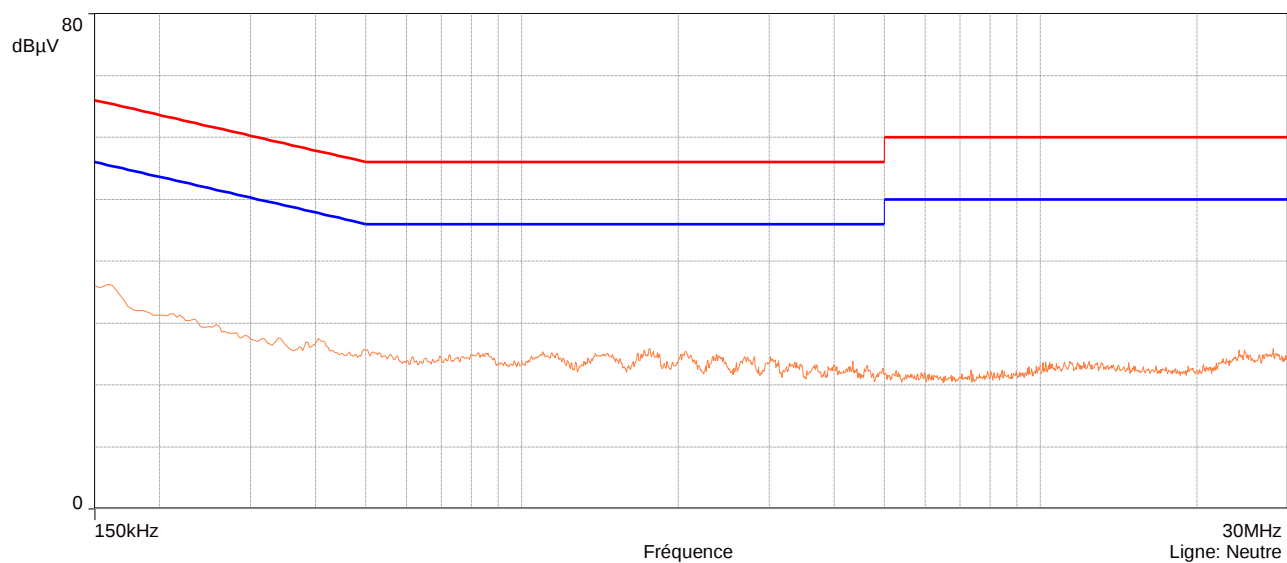
Results: WiFi 802.11.n with bandwidth of 40MHz

Sample N° 1:

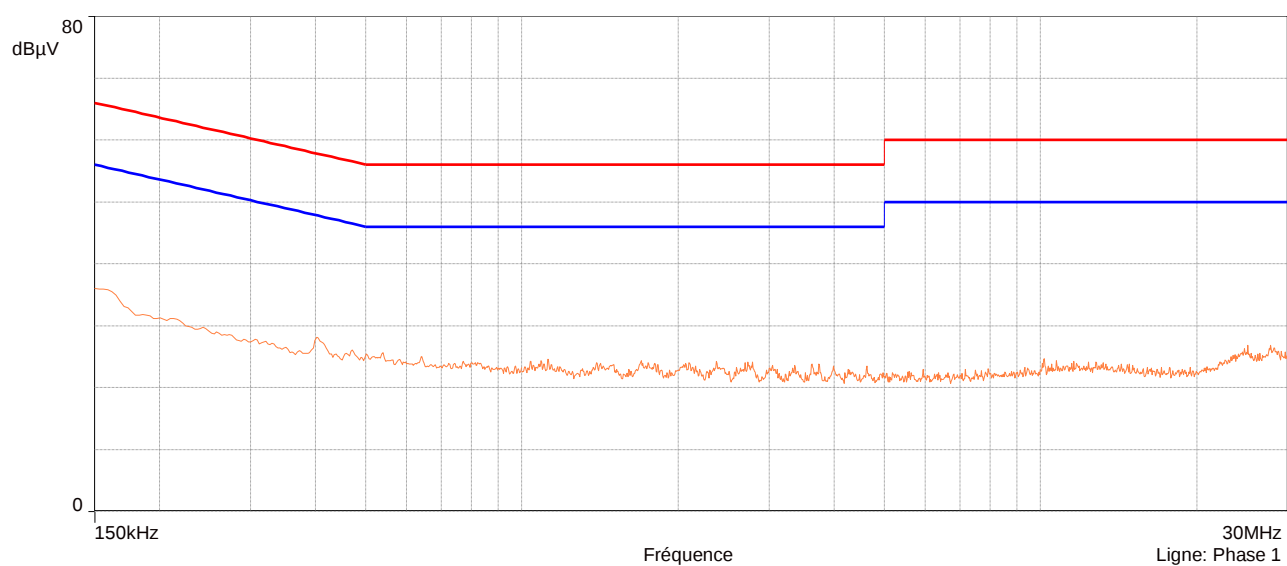
Measurement on the mains power supply:

The measurement is first realized with peak detector.

Curve N° 7: measurement on the Neutral with peak detector



Curve N° 8: measurement on the Line with peak detector



Test conclusion:

RESPECTED STANDARD

9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS**Temperature (°C) :** 23**Humidity (%HR):** 31**Date :** December 4, 2019**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** Paragraph 15.215**Test set up:**

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

Test operating condition of the equipment:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac by an external power supply

Percentage of voltage variation during the test (%):

 ± 1 **Radiated measurement**

Band edge worst case measurement on worst critical position

Results: WiFi 802.11.b (Bandwidth 20MHz)

Lower Band Edge: From 2400 MHz to 2402 MHz

Upper Band Edge: From 2483.5MHz to 2485.5 MHz

Sample N° 1

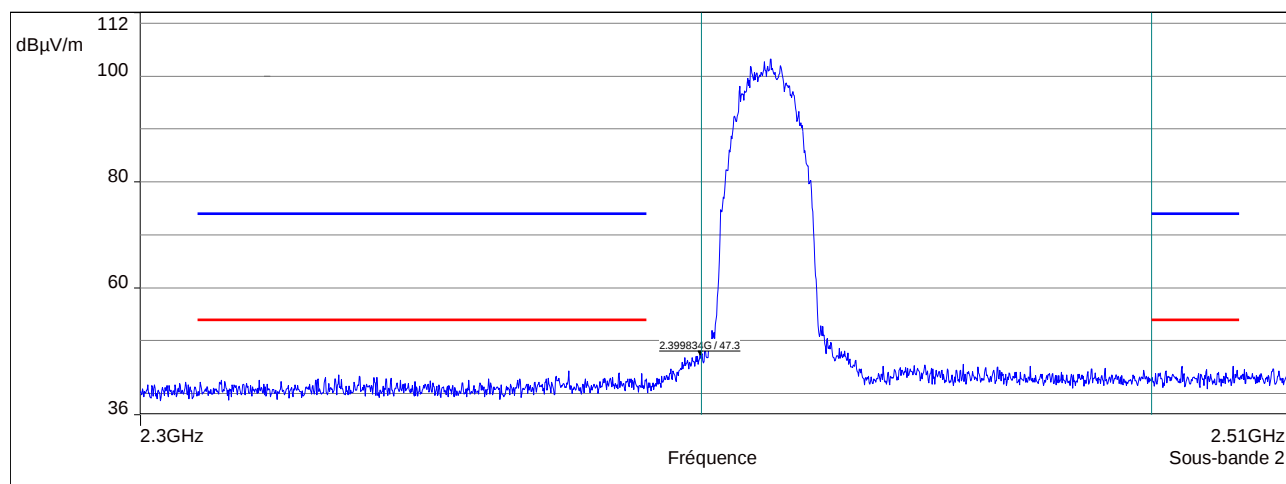
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2412	112.81	100	Peak	2399.8	65.51	47.3	82.81	35.11
2462	113.56	1000	Peak	2484.2	58.16	55.4	74	18.6
2462	113.56	1000	Average	2483.9	67.36	46.2	54	7.8

(1) Marker-Delta method

Sample N° 1 Channel 1 (F = 2412 MHz) – WiFi 802.11.b

LEGEND:

- Results obtained with 100 kHz RBW
- Blue curve represent measure and limit with a peak detector
- Green curve are the limit of the band.

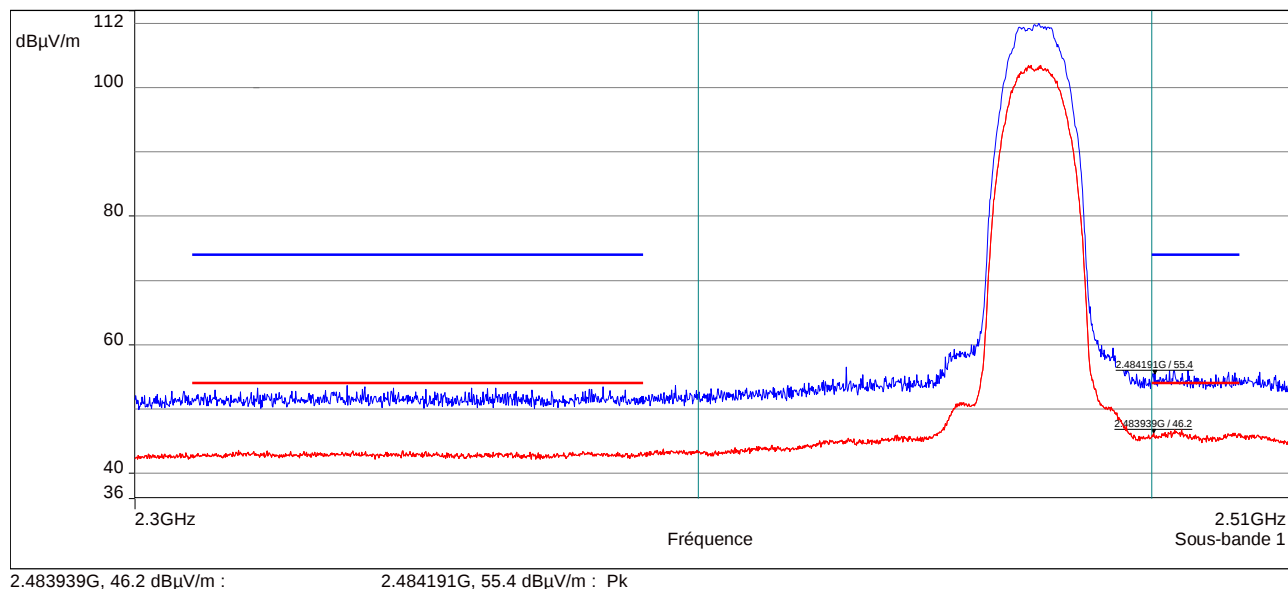


2.399834G, 47.3 dBμV/m :

Sample N° 1 Channel 11 (F = 2462 MHz) – WiFi 802.11.b

LEGEND:

- Results obtained with 1 MHz RBW
- Blue curve represent measure and limit with a peak detector
- Red curve with average detector.
- Green curve are the limit of the band.



Results: WiFi 802.11.g (Bandwidth 20MHz)

Lower Band Edge: From 2400 MHz to 2402 MHz

Upper Band Edge: From 2483.5MHz to 2485.5 MHz

Sample N° 1

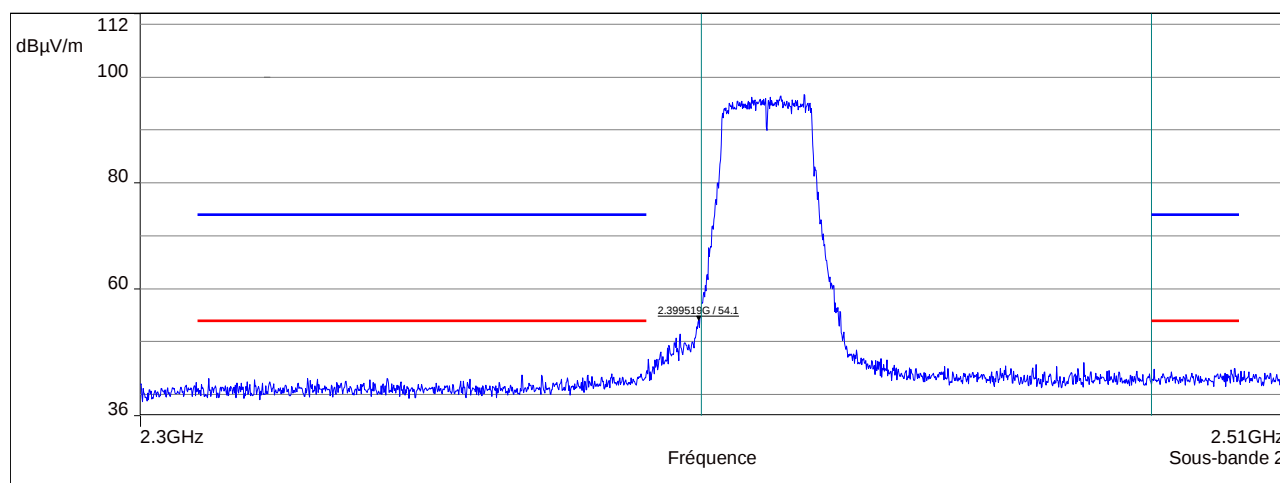
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2412	113.19	100	Peak	2399.5	59.09	54.1	83.19	29.09
2462	112.92	1000	Peak	2483.8	55.42	57.5	74	16.5
2462	112.92	1000	Average	2484.1	64.92	48.0	54	6.0

(1) Marker-Delta method

Sample N° 1 Channel 1 (F = 2412 MHz) – WiFi 802.11.g

LEGEND:

- Results obtained with 100 kHz RBW
- Blue curve represent measure and limit with a peak detector
- Green curve are the limit of the band.

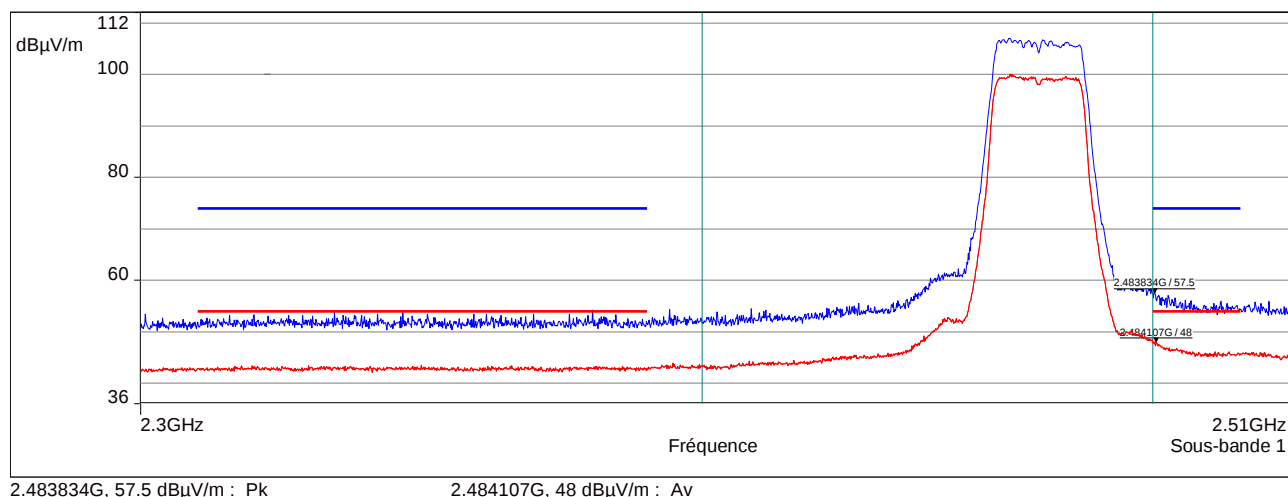


2.399519G, 54.1 dBμV/m :

Sample N° 1 Channel 11 (F = 2462 MHz) – WiFi 802.11.g

LEGEND:

- Results obtained with 1 MHz RBW
- Blue curve represent measure and limit with a peak detector
- Red curve with average detector.
- Green curve are the limit of the band.



Results: WiFi 802.11.n (Bandwidth 20MHz)

Lower Band Edge: From 2400 MHz to 2402 MHz

Upper Band Edge: From 2483.5MHz to 2485.5 MHz

Sample N° 1

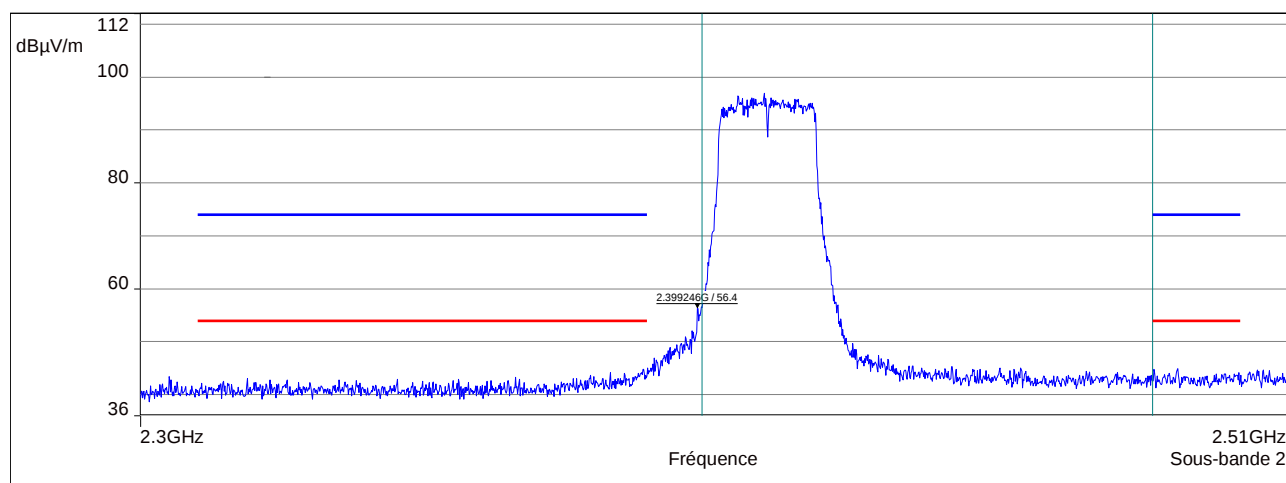
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2412	113.55	100	Peak	2399.2	57.45	56.4	83.55	27.15
2462	112.6	1000	Peak	2483.7	54.0	58.6	74	16.4
2462	112.6	1000	Average	2484.1	63.8	48.8	54	6.2

(1) Marker-Delta method

Sample N° 1 Channel 1 (F = 2412 MHz) – WiFi 802.11.n

LEGEND:

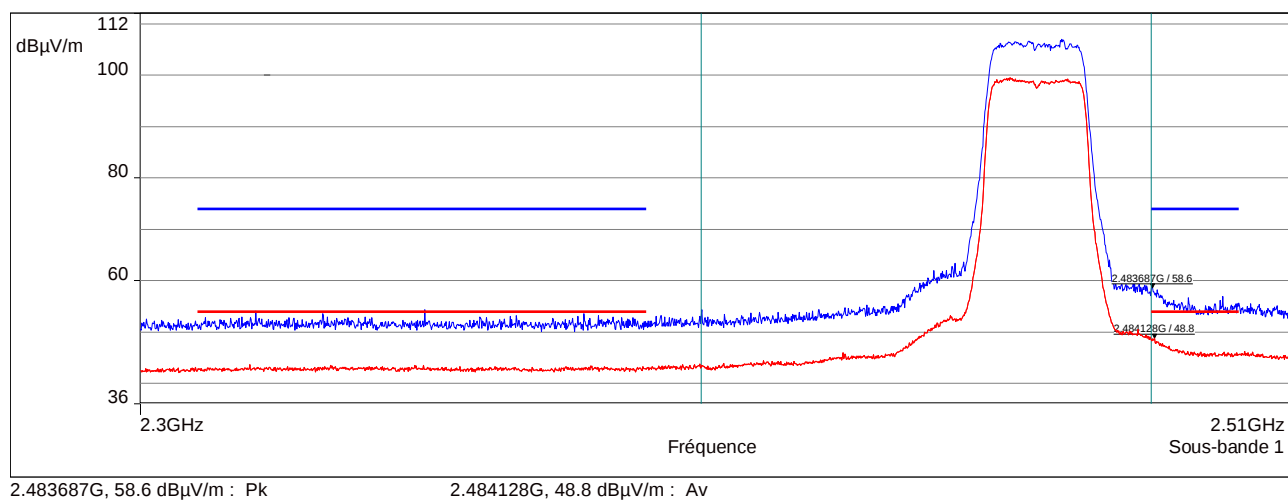
- Results obtained with 100 kHz RBW
- Blue curve represent measure and limit with a peak detector
- Green curve are the limit of the band.



Sample N° 1 Channel 11 (F = 2462 MHz) – WiFi 802.11.g

LEGEND:

- Results obtained with 1 MHz RBW
- Blue curve represent measure and limit with a peak detector
- Red curve with average detector.
- Green curve are the limit of the band.



Results: WiFi 802.11.n (Bandwidth 40MHz)

Lower Band Edge: From 2400 MHz to 2402 MHz

Upper Band Edge: From 2483.5MHz to 2485.5 MHz

Sample N° 1

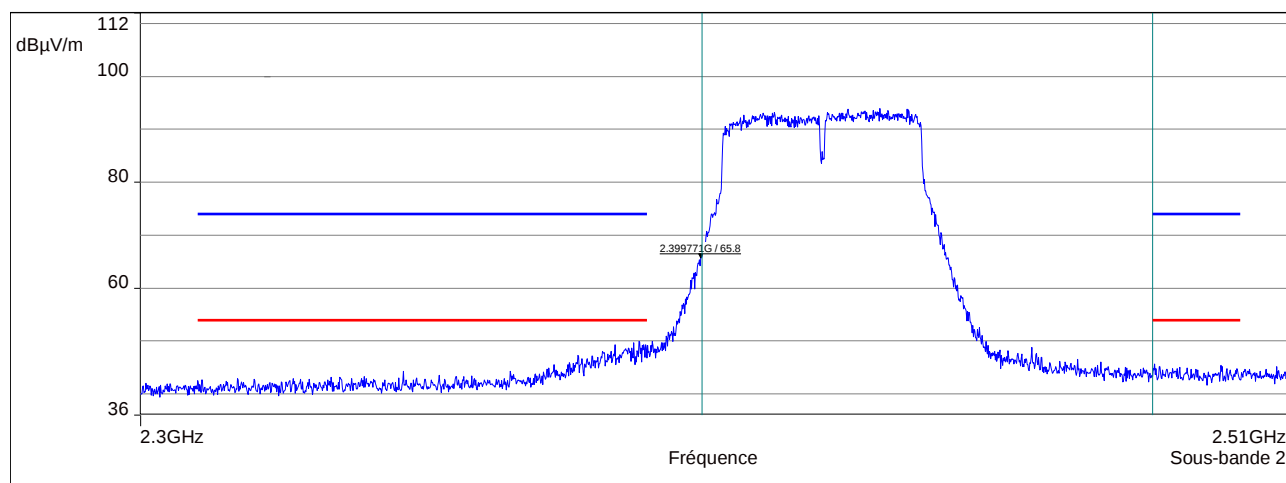
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2422	112.30	100	Peak	2399.7	46.5	65.8	82.30	16.5
2452	112.79	1000	Peak	2484.1	51.39	61.4	74	12.6
2452	112.79	1000	Average	2484.1	61.89	50.9	54	3.1

(1) Marker-Delta method

Sample N° 1 Channel 3 (F = 2422 MHz) – WiFi 802.11.n – BW=40MHz

LEGEND:

- Results obtained with 100 kHz RBW
- Blue curve represent measure and limit with a peak detector
- Green curve are the limit of the band.

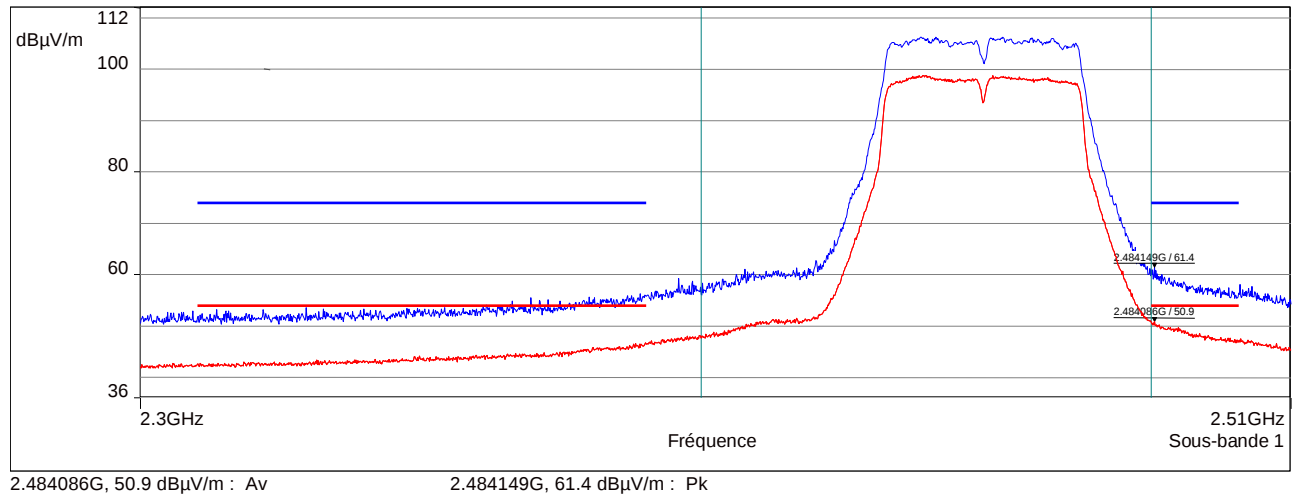


2.399771G, 65.8 dBμV/m :

Sample N° 1 Channel 11 (F = 2452 MHz) – WiFi 802.11.g – BW=40MHz

LEGEND:

- Results obtained with 1 MHz RBW
- Blue curve represent measure and limit with a peak detector
- Red curve with average detector.
- Green curve are the limit of the band.



Test conclusion:

RESPECTED STANDARD

10. MAXIMUM CONDUCTED (AVERAGE) OUTPUT POWER**Temperature (°C) :** 21.2**Humidity (%HR):** 37**Date :** December 9, 2019**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.247 (b)

AVGPM method (using an RF average-reading power meter) of paragraph 11.9.2.3.1 of ANSI C63.10

Test set up:

First an exploratory radiated measurement was performed.

During this phase the product is oriented in these two normal positions.

Then the final measurement is realized with the product on the most critical orientation.

The system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

The system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

Distance of antenna: 3 meters (in anechoic room)**Antenna height:** 1.5 meter (in anechoic room)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)

The measurement of the radiated electro-magnetic field is realized in radiated mode with a calibrated average reading power meter. (11.9.2.3.1 of ANSI C63.10).

Finally the radiated electro-magnetic field is converted in dBm with the following formula:

$$EIRP(dBm) = E (dB\mu V/m) + 20\log(D) - 104.8; \text{ where } D \text{ is the measurement distance in meters and antenna Gain} = 2.15dBi.$$
Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate in 802.11b, 802.11g and 802.11n modes (Bandwidth of 20MHz and 40MHz).

Power Setting: atten: 27x0.25**Power source:** 120 Vac by an external power supply**Percentage of voltage variation during the test (%):** ± 1

Results: 802.11.b Mode

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.b

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	15.43	0.035	1

Antenna gain considered: 2.15 dBi

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.b

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	15.07	0.032	1

Antenna gain considered: 2.15 dBi

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.b

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	16.18	0.041	1

Antenna gain considered: 2.15 dBi

Maximum conducted output power:

$EIRP(dBm) = E(dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance in meters and antenna Gain = 2.15 dBi.

Results: 802.11.g Mode

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.g

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	15.71	0.037	1

Antenna gain considered: 2.15 dBi

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.g

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	16.26	0.043	1

Antenna gain considered: 2.15 dBi

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.g

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	15.54	0.036	1

Antenna gain considered: 2.15 dBi

Maximum conducted output power:

$EIRP(dBm) = E(dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance in meters and antenna Gain = 2.15 dBi.

Results: 802.11.n Mode – BW = 20MHz

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.n

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	16.17	0.041	1

Antenna gain considered: 2.15 dBi

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.n

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	14.87	0.031	1

Antenna gain considered: 2.15 dBi

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.n

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	15.22	0.033	1

Antenna gain considered: 2.15 dBi

Maximum conducted output power:

$EIRP(dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance in meters and antenna Gain = 2.15 dBi.

Results: 802.11.n Mode – BW = 40MHz

Sample N° 1 Channel 3 (F = 2422 MHz) – Mode 802.11.n

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	14.92	0.031	1

Antenna gain considered: 2.15 dBi

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.n

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	15.23	0.033	1

Antenna gain considered: 2.15 dBi

Sample N° 1 Channel 9 (F = 2452 MHz) – Mode 802.11.n

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:120V	15.41	0.035	1

Antenna gain considered: 2.15 dBi

Maximum conducted output power:

$EIRP(dBm) = E(dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance in meters and antenna Gain = 2.15 dBi.

Test conclusion:

RESPECTED STANDARD

11. INTENTIONAL RADIATOR**Temperature (°C) :** 23**Humidity (%HR):** 31**Date :** December 4, 2019**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)

Emissions in non-restricted frequency bands method of paragraph 11.11 of ANSI C63.10

Emissions in restricted frequency bands method of paragraph 11.12 of ANSI C63.10

Test set up:

First an exploratory radiated measurement was performed.

During this phase the product is oriented in these two normal positions.

Then the final measurement is realized with the product on the most critical orientation.

The measure is realized on open area test site under 1 GHz and in anechoic chamber above 1 GHz.

When the system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency 26 GHz**Detection mode:** Quasi-peak ($F < 1$ GHz)Peak / Average ($F > 1$ GHz)**Bandwidth:** 200Hz ($9 \text{ kHz} < F < 150\text{kHz}$)
9 kHz ($150 \text{ kHz} < F < 30\text{MHz}$)
120 kHz ($30 \text{ MHz} < F < 1 \text{ GHz}$)
100 kHz / 1 MHz ($F > 1 \text{ GHz}$)**Distance of antenna:** 10 meters (in open area test site) / 3 meters (in anechoic room)**Antenna height:** 1 to 4 meters (in open area test site) / 1.5 meter (in anechoic room)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate in 802.11b, 802.11g and 802.11n modes (Bandwidth of 20MHz and 40MHz).

Power Setting: atten: 27x0.25

Power source: 120 Vac by an external power supply

Percentage of voltage variation during the test (%): ± 1

Results: Mode 802.11.b

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.b

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3215.8	P	150	100	1	V	43.8	83.6	39.8
4824 (1)	P	150	1000	1	H	61.1	74	12.9
4824 (1)	Av	150	1000	1	H	52.1	54	1.9
12060 (1)	P	150	1000	2	H	53.9 (2)	74	20.1

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.b

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3249.5	P	150	100	1	V	42.8	83.6	40.8
4874 (1)	P	150	1000	1	H	62.1	74	12.9
4874 (1)	Av	150	1000	1	H	53.1	54	0.9
12186 (1)	P	150	1000	2	H	53.6 (2)	74	20.4

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.b

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3282.8	P	150	100	1	V	44.7	83.6	38.9
4924 (1)	P	150	1000	1	H	62.6	74	11.4
4924 (1)	Av	150	1000	1	H	53.6	54	0.4
12310 (1)	P	150	1000	2	H	50.4 (2)	74	23.6

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 113.6 dB μ V/m on high channel.

So the applicable limit is 83.6 dB μ V/m.

In addition, radiated emissions which fall in the restricted band, 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)).

Results: Mode 802.11.g

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.g

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3216.1	P	150	100	1	V	45.2	83.6	38.4
4824 (1)	P	150	1000	1	H	56.8	74	17.2
4824 (1)	Av	150	1000	1	H	48.8	54	5.2
12060 (1)	P	150	1000	1	V	51.3 (2)	74	22.7

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.g

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3249.1	P	150	100	1	V	43.8	83.6	39.8
4874 (1)	P	150	1000	1	H	56.3	74	17.7
4874 (1)	Av	150	1000	1	H	48.3	54	5.7

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.g

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3282.8	P	150	100	1	V	44.5	83.6	39.1
4924 (1)	P	150	1000	1	H	59.6	74	14.4
4924 (1)	Av	150	1000	1	H	51.6	54	2.4

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 113.6 dB μ V/m on central channel.

So the applicable limit is 83.6 dB μ V/m.

In addition, radiated emissions which fall in the restricted band, 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)).

Results: Mode 802.11.n – BW 20MHz

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3216.1	P	150	100	1	V	43.4	83.6	40.2
4824 (1)	P	150	1000	1	H	59.7	74	14.3
4824 (1)	Av	150	1000	1	H	51.7	54	2.3
12060 (1)	P	150	1000	1	V	51.6 (2)	74	22.4

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3249.1	P	150	100	1	V	42.9	83.6	40.7
4874 (1)	P	150	1000	1	H	55.6	74	18.4
4874 (1)	Av	150	1000	1	H	47.6	54	6.4

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3282.8	P	150	100	1	V	42.9	83.6	40.7
4924 (1)	P	150	1000	1	H	61.0	74	13.0
4924 (1)	Av	150	1000	1	H	53.4	54	0.6

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 113.6 dB μ V/m on low channel.

So the applicable limit is 83.6 dB μ V/m.

In addition, radiated emissions which fall in the restricted band, 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)).

Results: Mode 802.11.n – BW 40MHz

Sample N° 1 Channel 3 (F = 2422 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3229.3	P	150	100	1	V	45.3	82.8	37.5
4844 (1)	P	150	1000	1	H	57.4	74	19.6
4844 (1)	Av	150	1000	1	H	47.0	54	7.0

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3249.5	P	150	100	1	V	43.9	82.8	38.9
4874 (1)	P	150	1000	1	H	56.2	74	17.8
4874 (1)	Av	150	1000	1	H	45.8	54	8.2

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Sample N° 1 Channel 9 (F = 2452 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
3269.3	P	150	100	1	V	44.6	82.8	38.2
4904 (1)	P	150	1000	1	H	58.1	74	15.9
4904 (1)	Av	150	1000	1	H	47.7	54	6.3

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dBμV/m).

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 112.8 dB μ V/m on high channel.

So the applicable limit is 82.8 dB μ V/m.

In addition, radiated emissions which fall in the restricted band, 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)).

Test conclusion:

RESPECTED STANDARD

12. MAXIMUM CONDUCTED POWER DENSITY**Temperature (°C) :** 21**Humidity (%HR):** 37**Date :** December 9, 2019**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.247 (e), paragraph 15.247 (f)

AVGSPD-1 of paragraph 11.10.3 of ANSI C63.10

Test set up:

First an exploratory radiated measurement was performed.

During this phase the product is oriented in these two normal positions.

Then the final measurement is realized with the product on the most critical orientation.

The system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

The system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

Distance of antenna: 3 meters (in anechoic room)**Antenna height:** 1.5 (in anechoic room)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)

The measurement of the radiated electro-magnetic field is realized with an analyser.

For 802.11.b, g, n mode with Nominal Bandwidth of 20MHz:

Span:	30 MHz
Resolution bandwidth:	30 kHz
Video bandwidth:	100 kHz
Detector:	RMS
Number of points:	8001
Sweep time:	Auto
Trace mode:	Average Power
Sweep count	100

Then the peak marker function is used.

For 802.11.n mode with Nominal Bandwidth of 40MHz:

Span:	60 MHz
Resolution bandwidth:	30 kHz
Video bandwidth:	100 kHz
Detector:	RMS
Number of points:	8001
Sweep time:	Auto
Trace mode:	Average Power
Sweep count	100

Then the peak marker function is used.

Finally the radiated electro-magnetic field is converted in dBm with the following formula:

$EIRP(dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance in meters and antenna Gain = 2.15 dBi.

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate in 802.11b, 802.11g and 802.11n modes (Bandwidth of 20MHz and 40MHz).

Power Setting: atten: 27x0.25

Power source: 120 Vac by an external power supply

Percentage of voltage variation during the test (%): ± 1

Results: 802.11.b Mode

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.b

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-6.31	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.b

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-6.19	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.b

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-5.83	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Results: 802.11.g Mode

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.g

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-7.65	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.g

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-7.33	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.g

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-7.87	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Results: 802.11.n Mode – BW 20 MHz

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11.n

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-7.86	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.n

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-8.51	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.n

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-8.96	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Results: 802.11.n Mode – BW 40 MHz

Sample N° 1 Channel 3 (F = 2422 MHz) – Mode 802.11.n

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-12.65	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11.n

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-12.55	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Sample N° 1 Channel 9 (F = 2452 MHz) – Mode 802.11.n

	Maximum conducted power density (dBm / 30 kHz)	Limit (dBm / 30 kHz)
Nominal supply voltage:120V	-12.72	8

Considered maximum antenna gain: 2.15 dBi

See curve in appendix 4

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 4 appendixes to be forwarded □□□

APPENDIX 1 Test equipment list

Conducted limits

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	10788
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSV40	Rohde & Schwarz	15666
LISN 1600	Thurbly Thandar Instruments	8719
High-pass filter EZ-25	Rohde & Schwarz	8635
Absorber sheath current	Emitech	10651
Cable N-5m RG214	Gyl Technologies	8590
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.17.0.25	0000

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	EMCO	8535
Antenna 3117	ETS-Lindgren	10771
Low-noise amplifier PAM-118A	COM-POWER	15812
N-1.5M Cable	Huber + Suhner	6884
N-2M Cable	Huber + Suhner	12911
N-5M Cable	SUCOFLEX	15882
Attenuator 20dB	Midwest Microwave	8549
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBSHOT V2.4	-
Software	BAT-EMC V3.17.0.25	0000

Maximum conducted (average) output power

TYPE	MANUFACTURER	EMITECH NUMBER
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3117	ETS-Lindgren	10771
Low-noise amplifier S005180M3201	LUCIX Corp.	12590
N-1.5M Cable	SUCOFLEX	9398
N-2M Cable	SUCOFLEX	14303
N-2.5M Cable	SUCOFLEX	14304
N-5M Cable	Huber + Suhner	12912
Attenuator 20dB	Midwest Microwave	8549
Powermeter NRV-Z52	Rohde & Schwarz	8742
Powermeter NRVS	Rohde & Schwarz	8702
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14903
Meteo station 608-H1	Testo	7566
Meteo station WS-9232	La Crosse Technology	8749
Software	BAT-EMC V3.17.0.25	0000

Intentional radiator

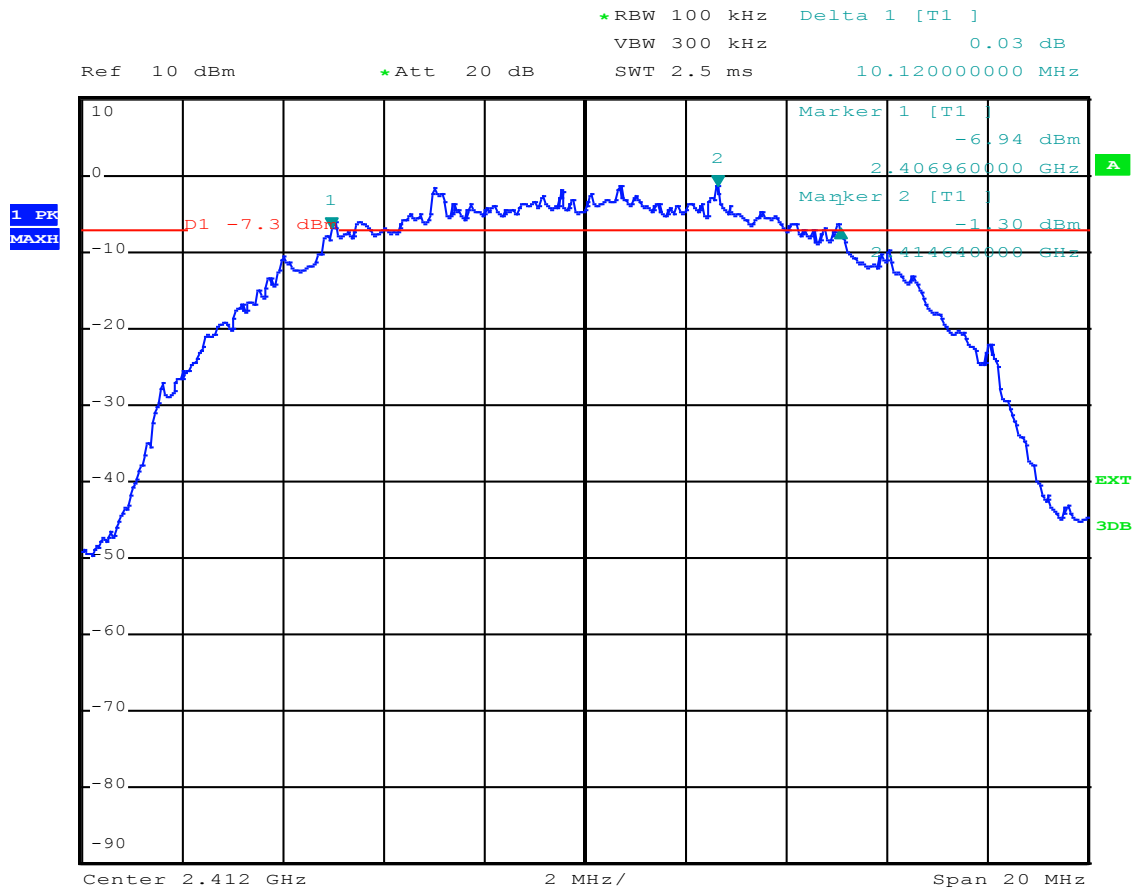
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna 3110	Emco	7240
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Antenna 3115	EMCO	8535
Antenna SAS-572	A.H Systems	7124
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier ZFL-1000LN	Mini-circuit	10730
Low-noise amplifier PAM-118A	COM-POWER	15812
Low-noise amplifier S180265L3201	LUCIX Corp.	8704
N-1.5M Cable	Huber + Suhner	6884
N-1.5M Cable	SUCOFLEX	9398
N-2M Cable	Huber + Suhner	12911
N-5M Cable	SUCOFLEX	15882
N-1M Cable	SUCOFLEX	14302
N-2M Cable	SUCOFLEX	14303
N-2.5M Cable	SUCOFLEX	14304
N-5M Cable	Huber + Suhner	12912
Cable k-20cm	STORM MICROWAE	8974
Cable k-20cm	STORM MICROWAE	8975
Low pass filter LP03/1000-7GH	Filtek	4087
Reject band filter BRM50702	Microtronics	7299
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14903
Meteo station 608-H1	Testo	7566
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.17.0.25	0000

Maximum conducted power density

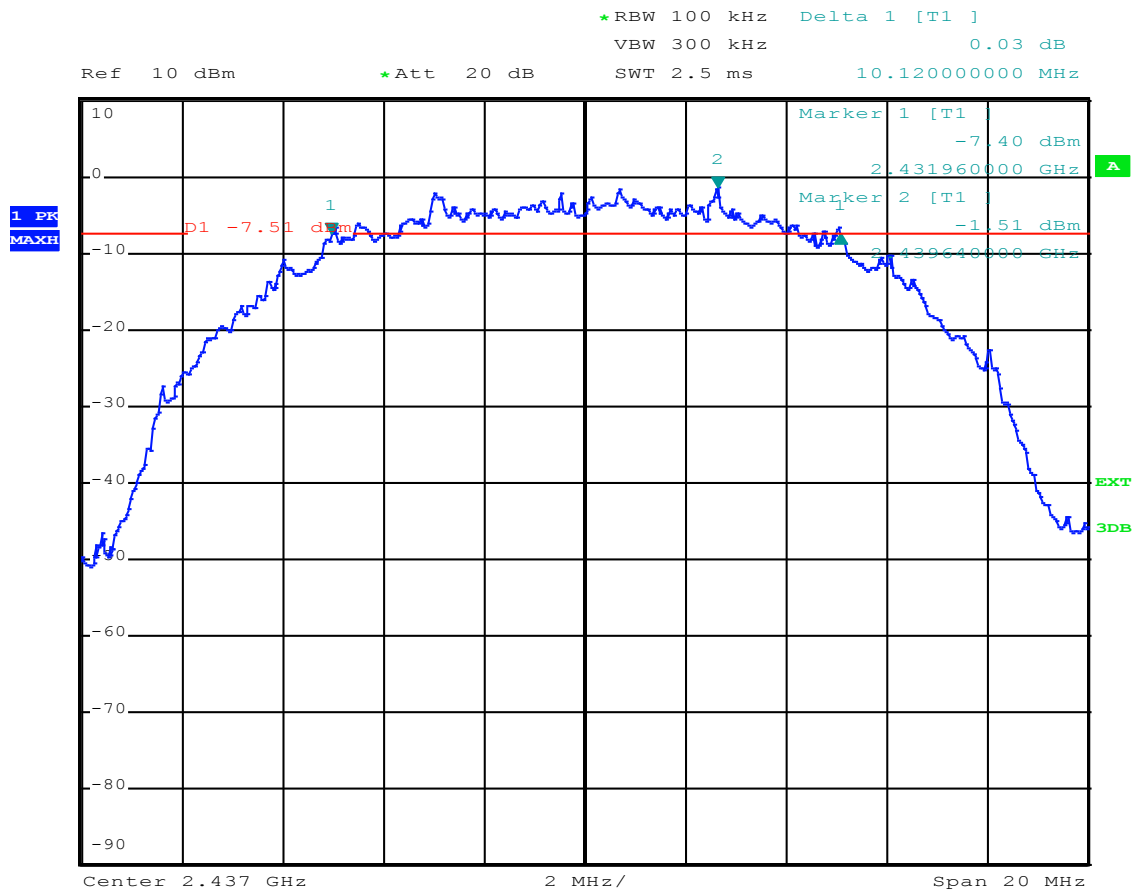
TYPE	MANUFACTURER	EMITECH NUMBER
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3117	ETS-Lindgren	10771
Low-noise amplifier S005180M3201	LUCIX Corp.	12590
N-1.5M Cable	SUCOFLEX	9398
N-2M Cable	SUCOFLEX	14303
N-2.5M Cable	SUCOFLEX	14304
N-5M Cable	Huber + Suhner	12912
Attenuator 20dB	Midwest Microwave	8549
Powermeter NRV-Z52	Rohde & Schwarz	8742
Powermeter NRVS	Rohde & Schwarz	8702
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14903
Meteo station 608-H1	Testo	7566
Meteo station WS-9232	La Crosse Technology	8749
Software	BAT-EMC V3.17.0.25	0000

APPENDIX 2: 6 dB bandwidth

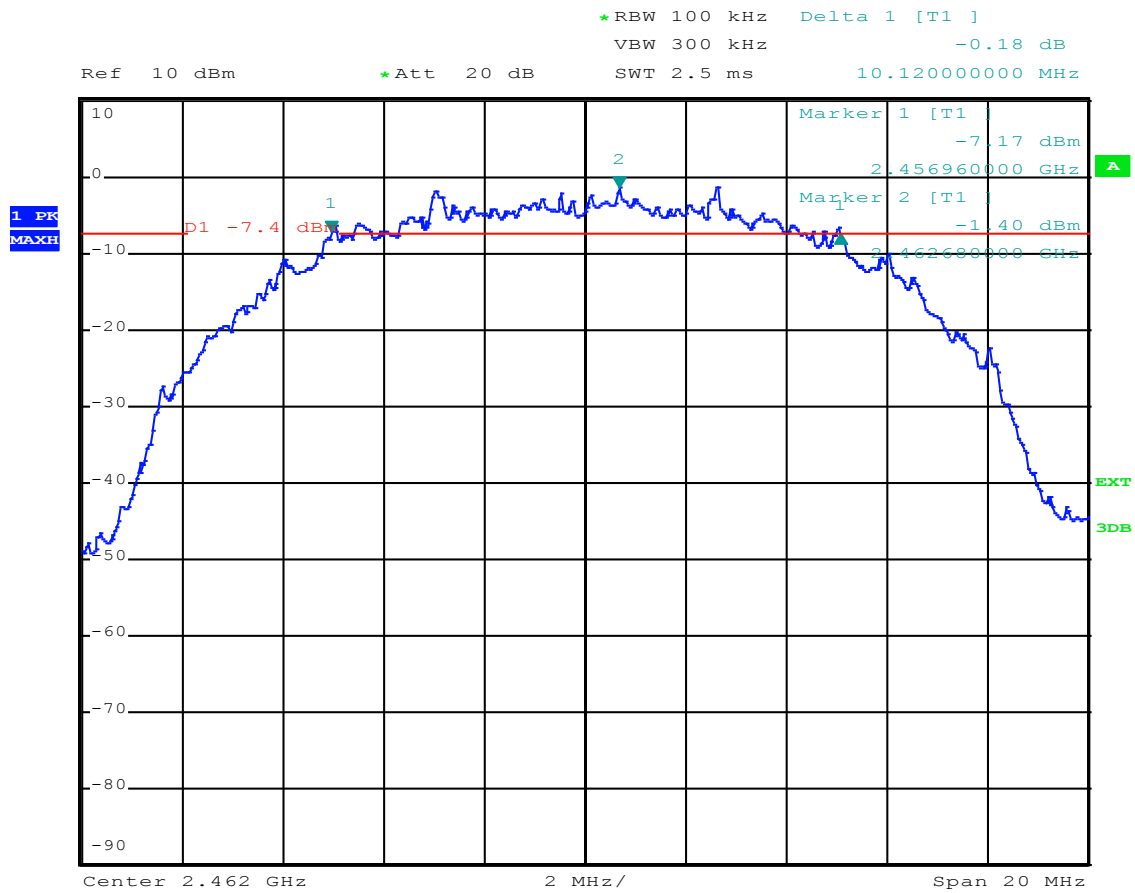
Low Channel – 802.11.b



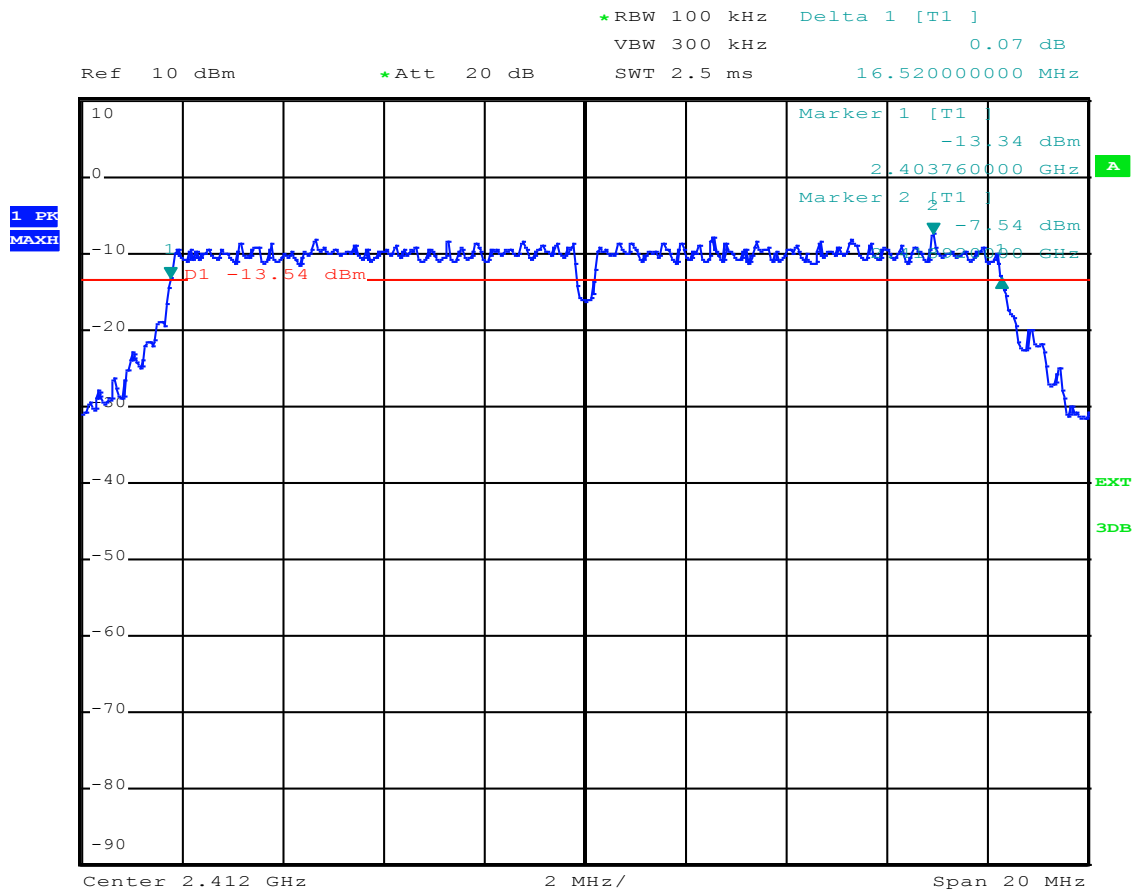
Central Channel – 802.11.b



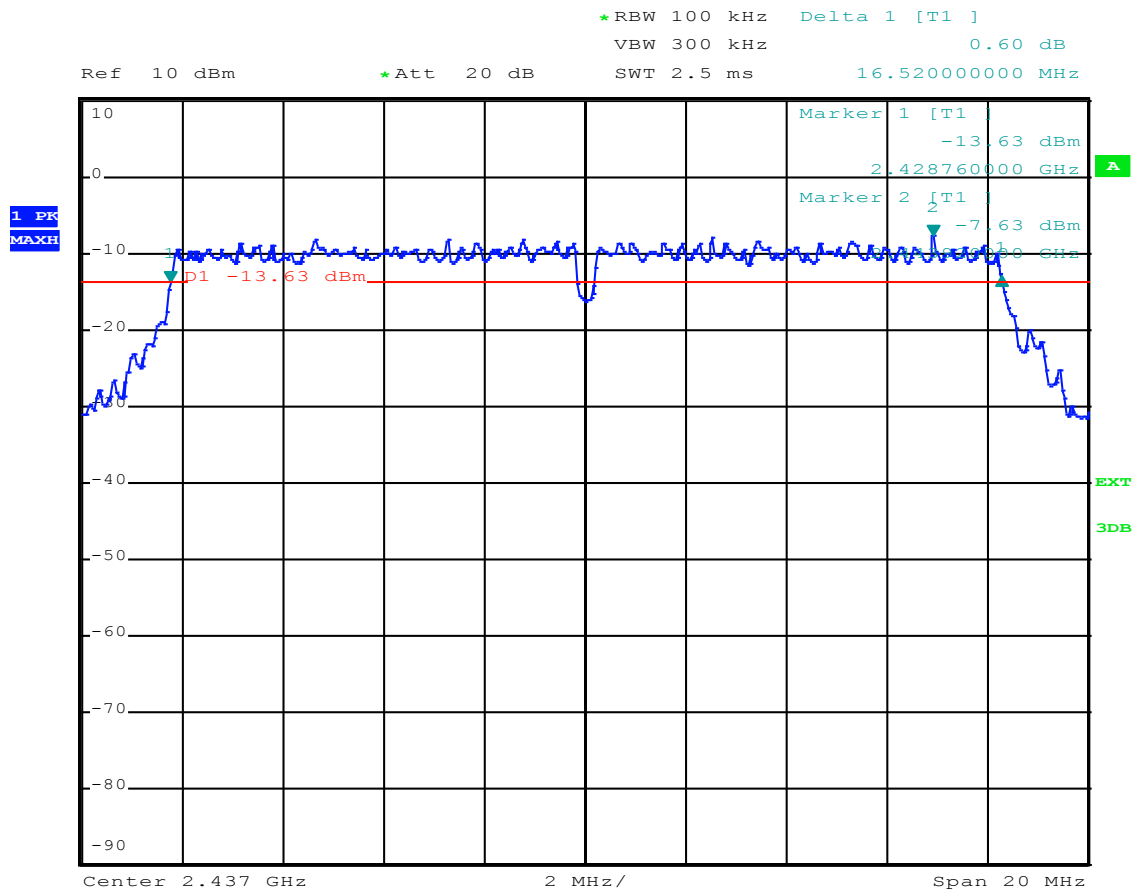
High Channel – 802.11.b



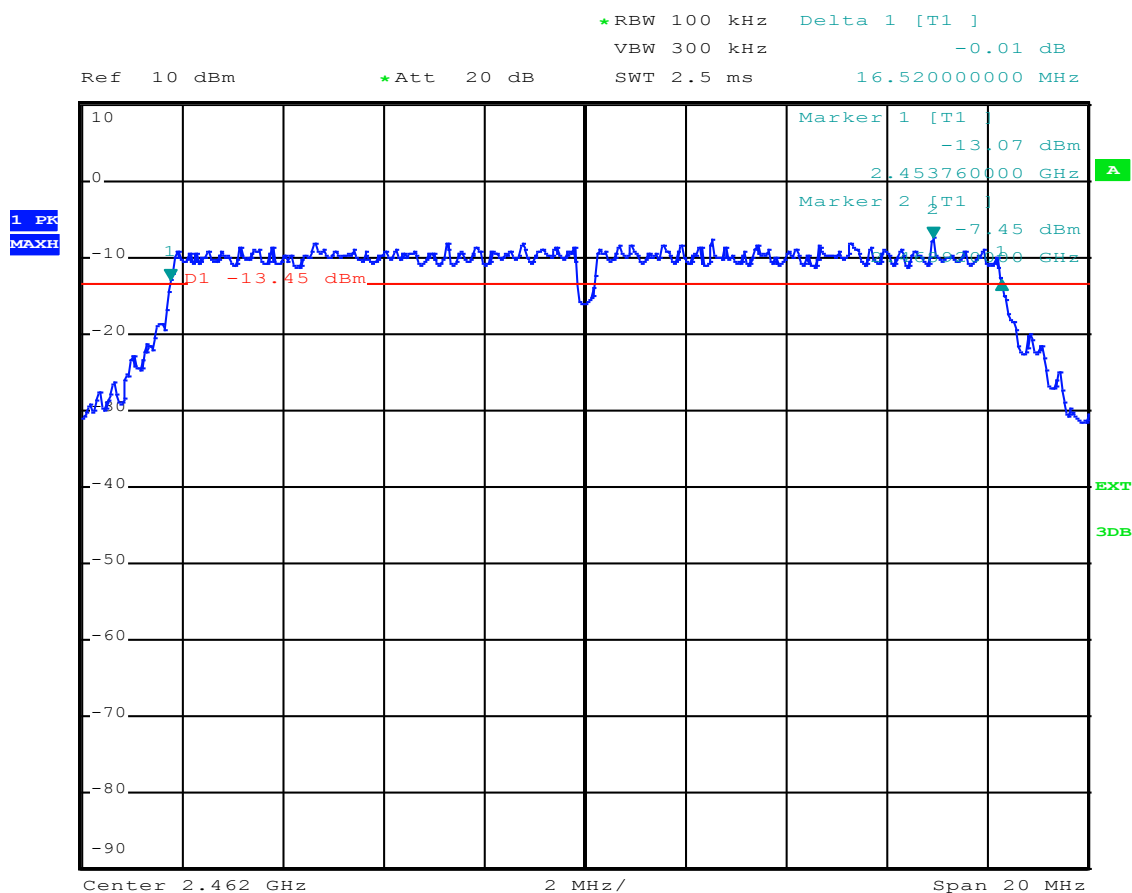
Low Channel – 802.11.g



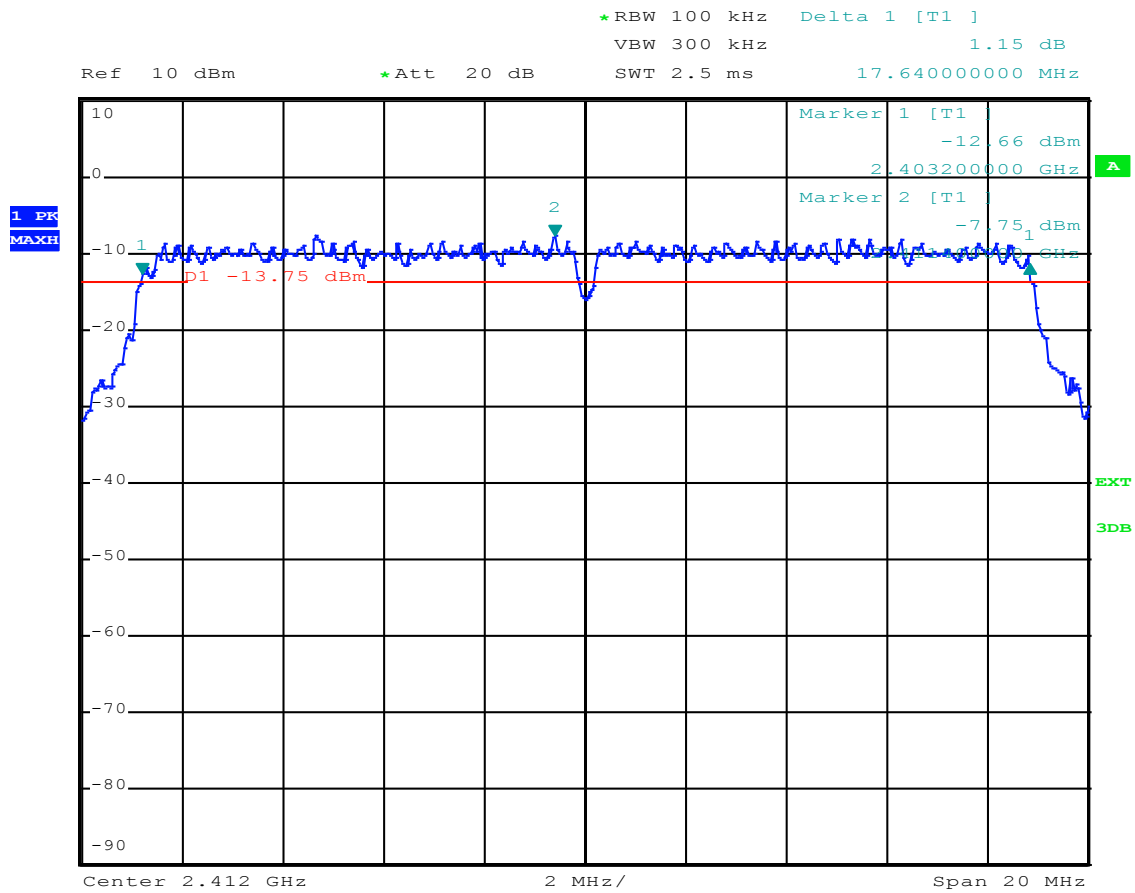
Central Channel – 802.11.g



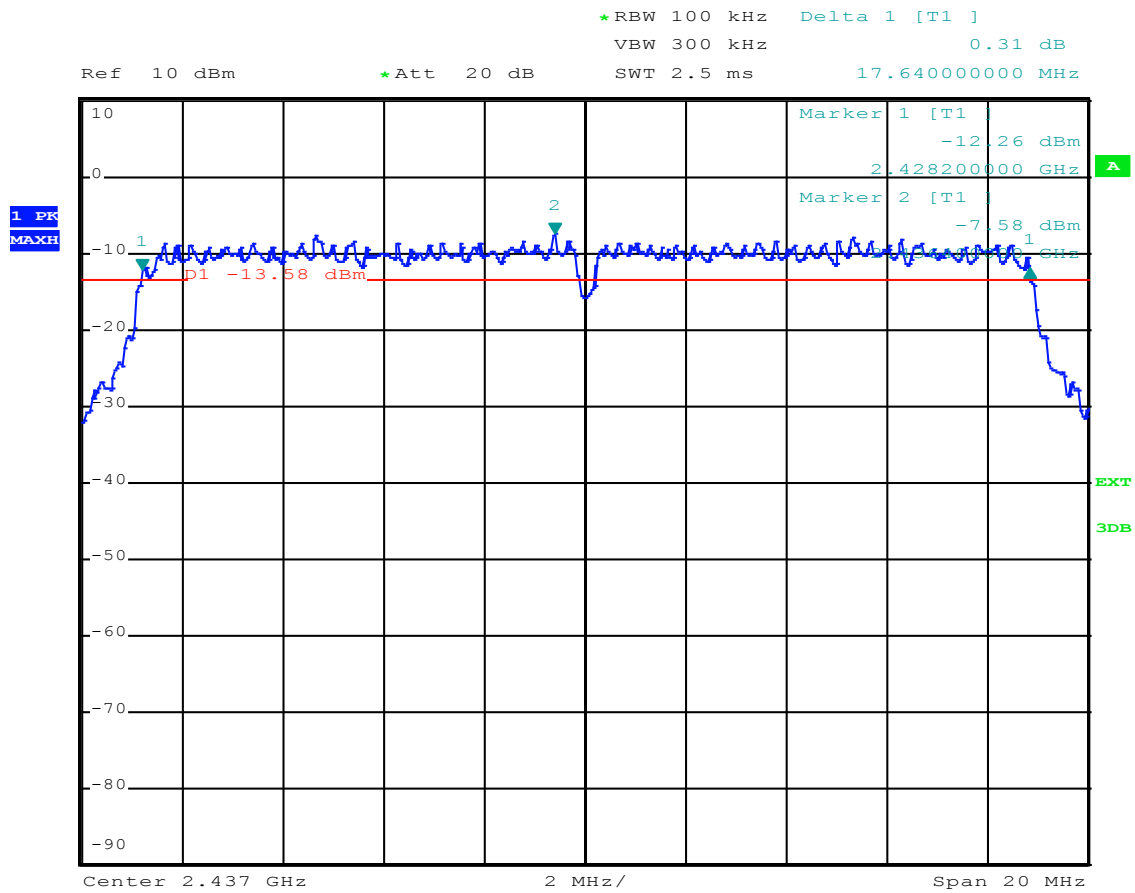
High Channel – 802.11.g



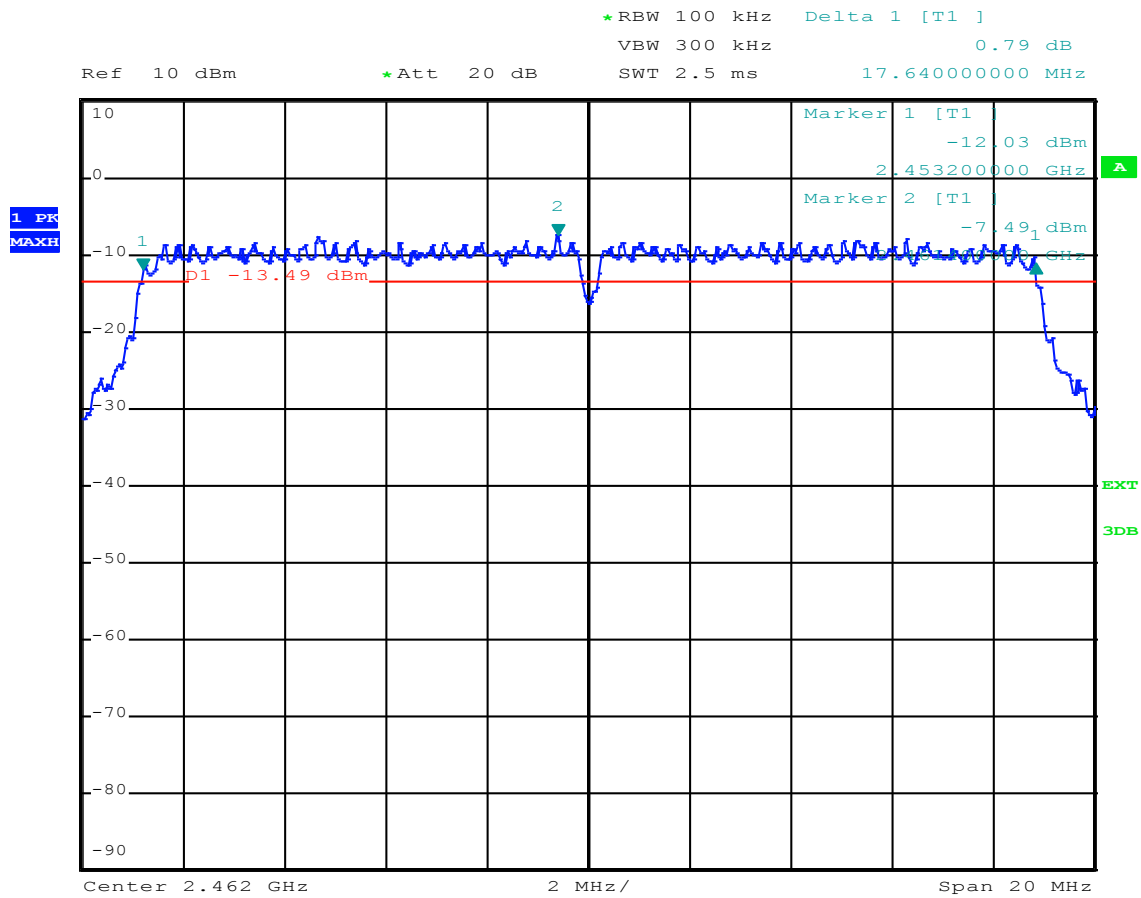
Low Channel – 802.11.n – BW 20MHz



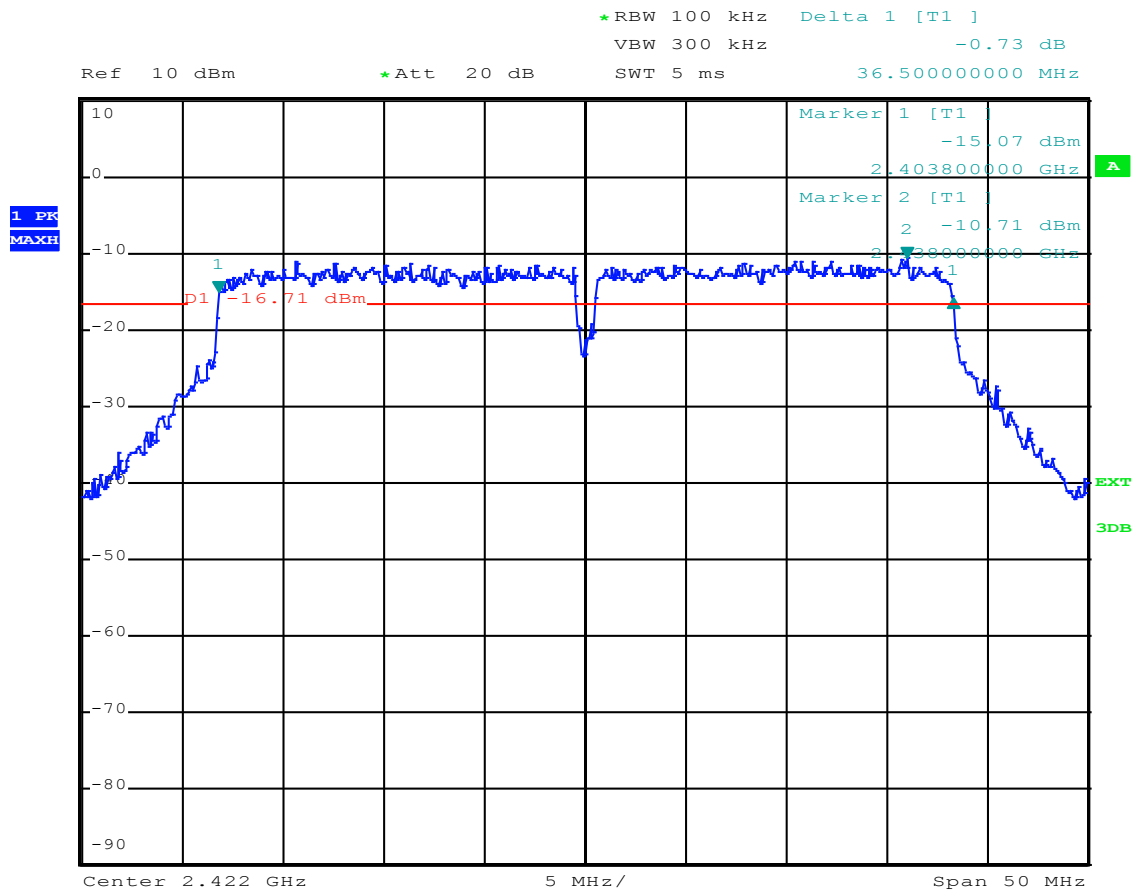
Central Channel – 802.1.n – BW 20MHz



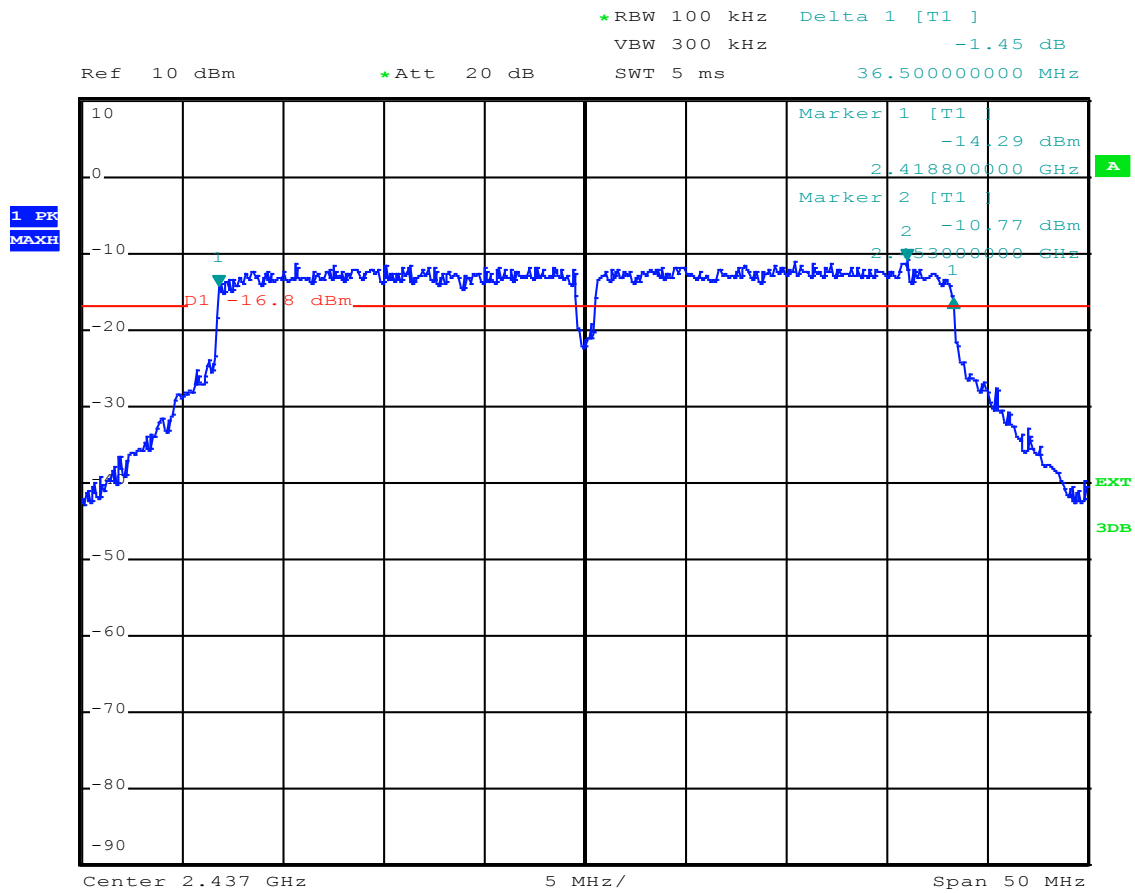
High Channel – 802.11.n – BW 20MHz



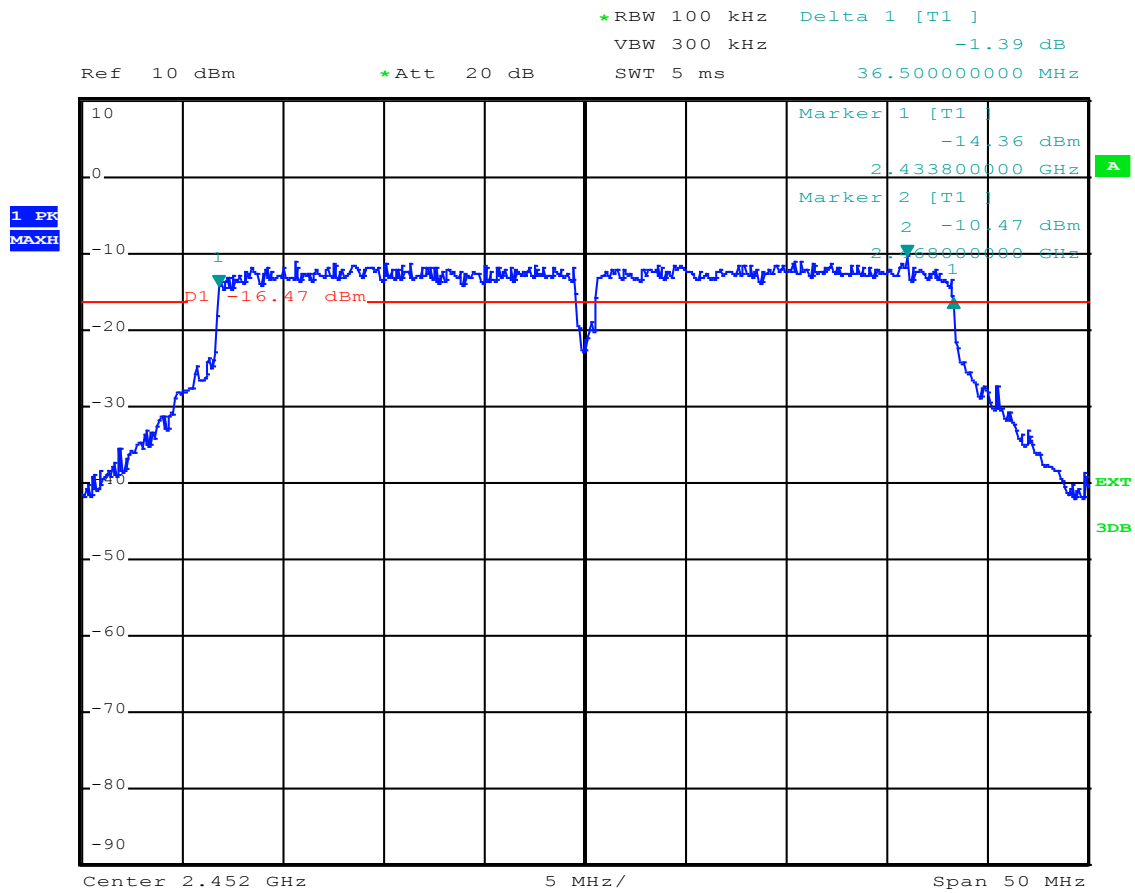
Low Channel – 802.11.n – BW 40MHz



Central Channel – 802.11.n – BW 40MHz

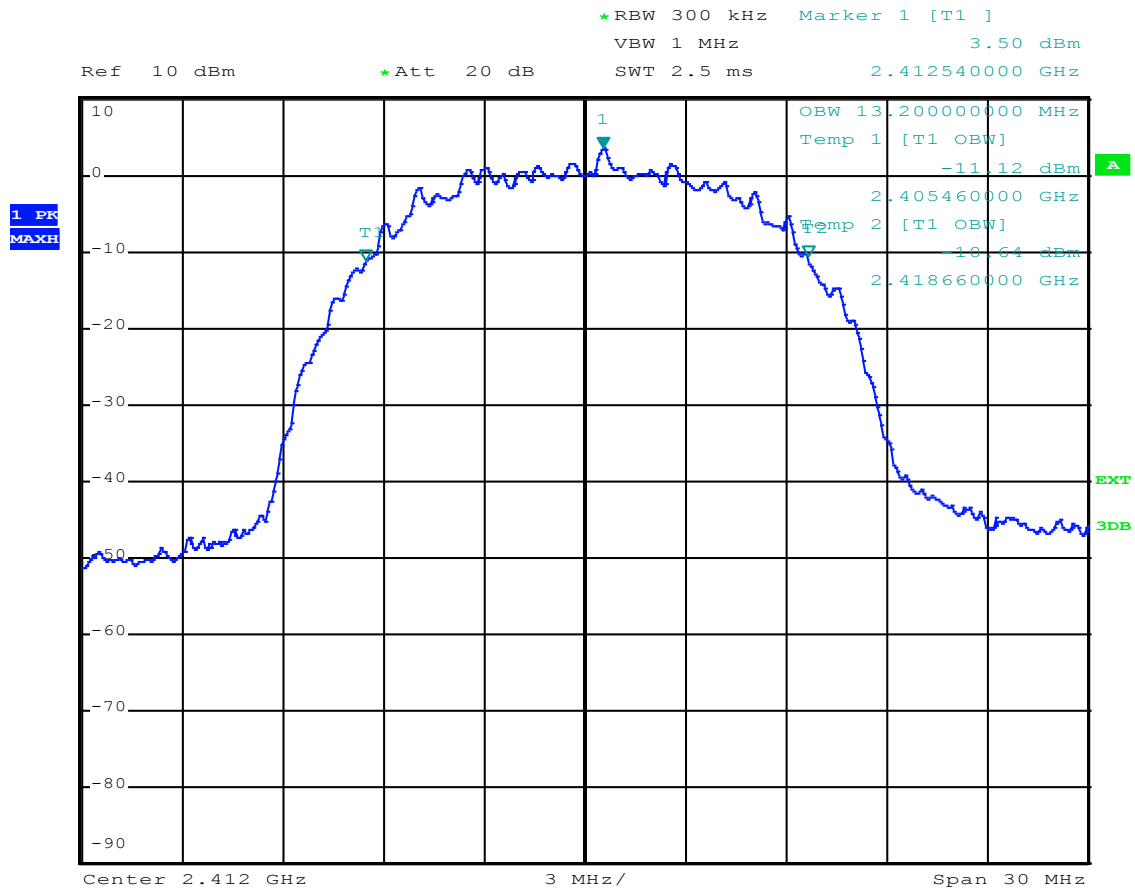


High Channel – 802.11.n – BW 40MHz

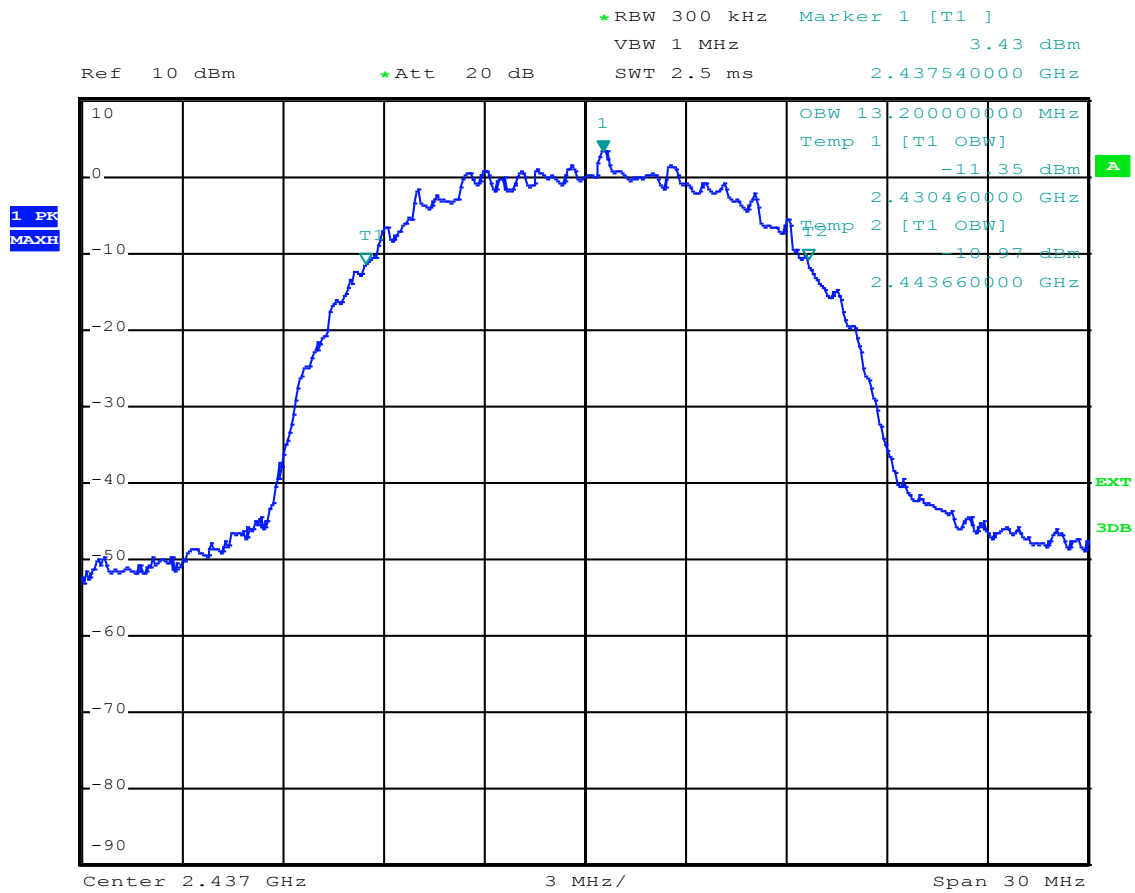


APPENDIX 3: 99% bandwidth

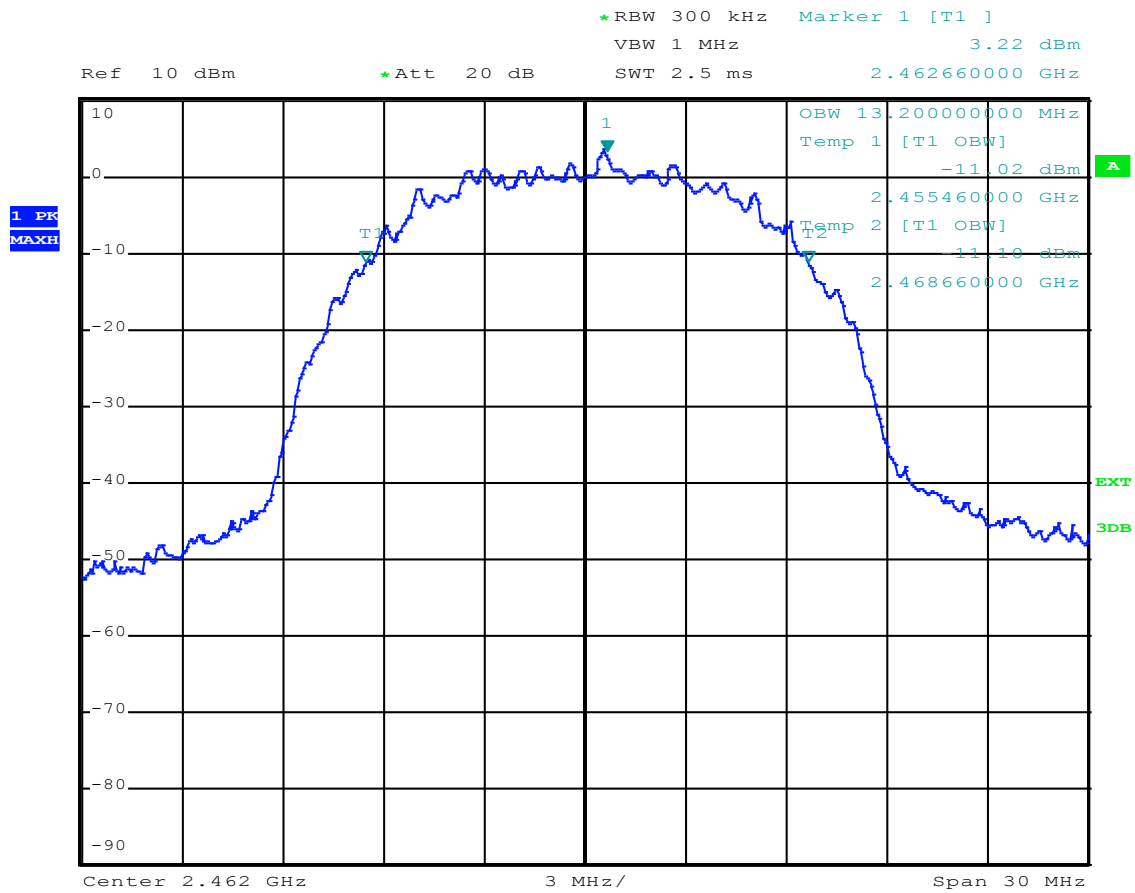
Low Channel – 802.11.b



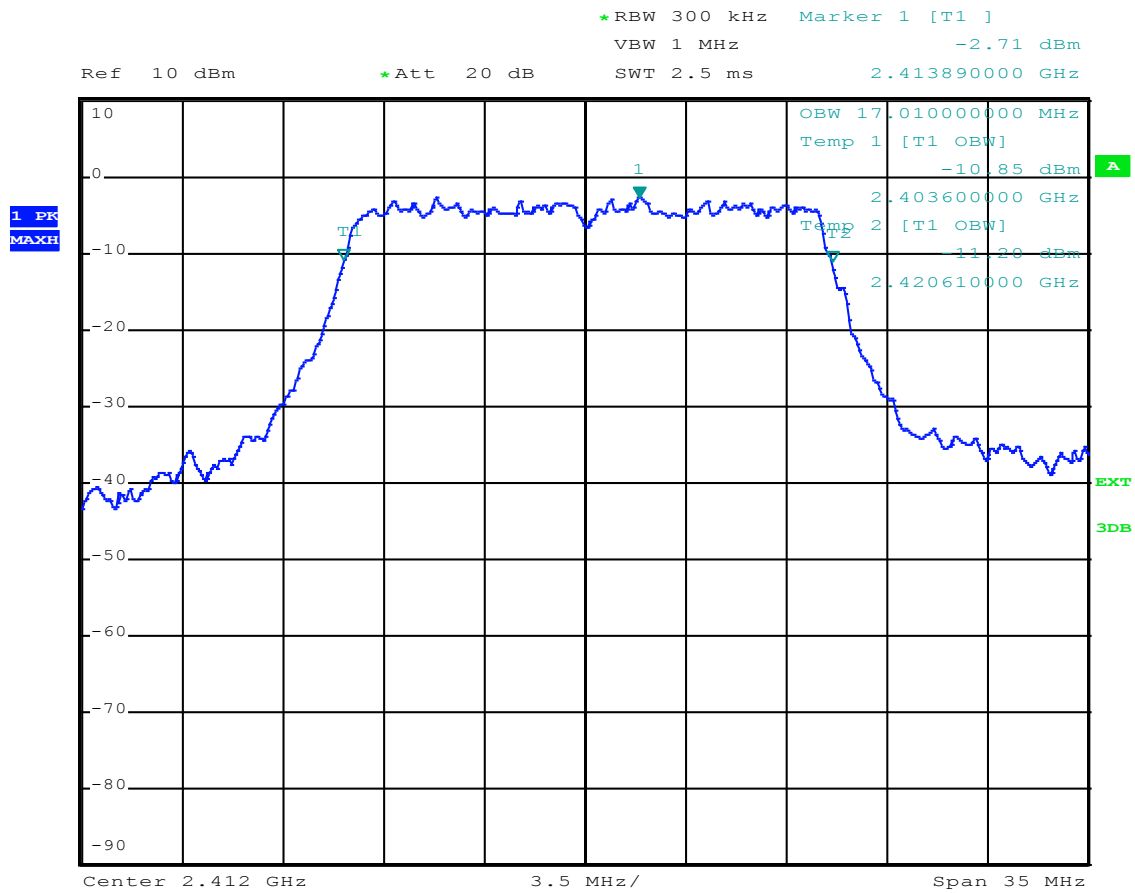
Central Channel – 802.11.b



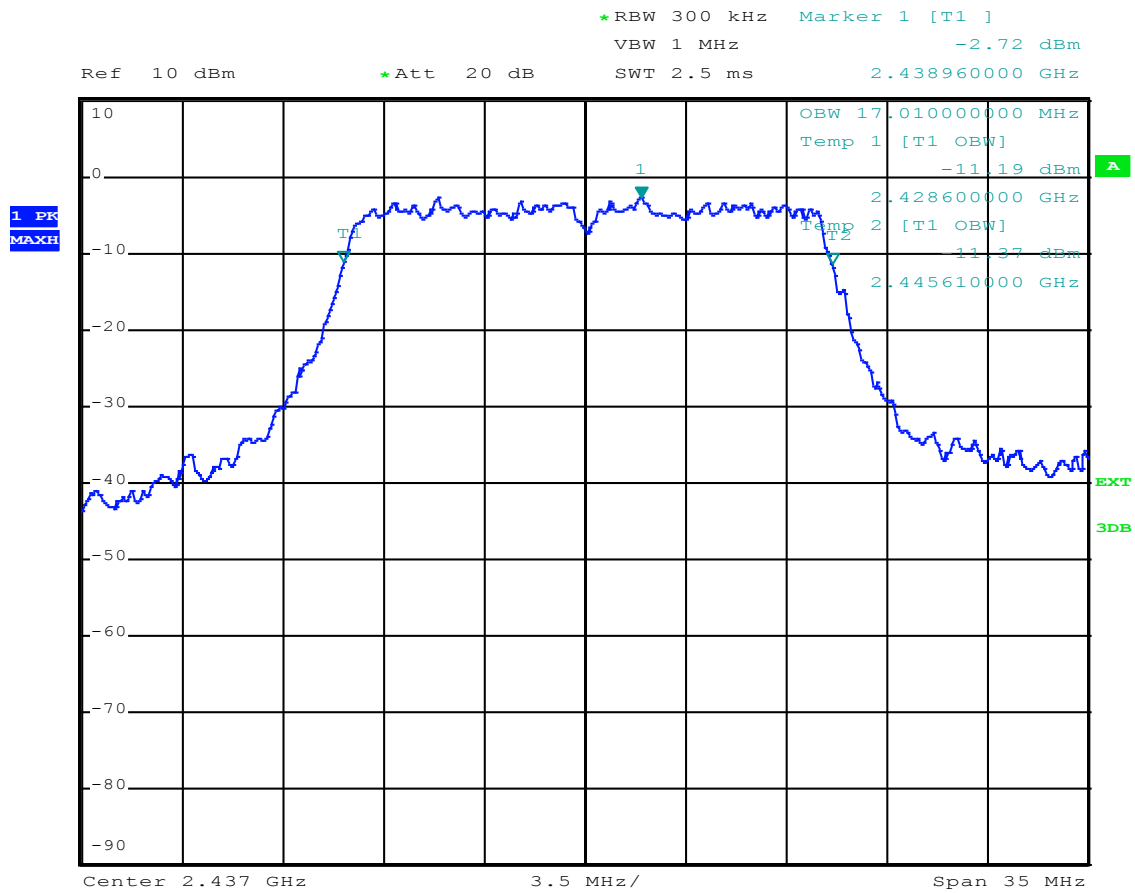
High Channel – 802.11.b



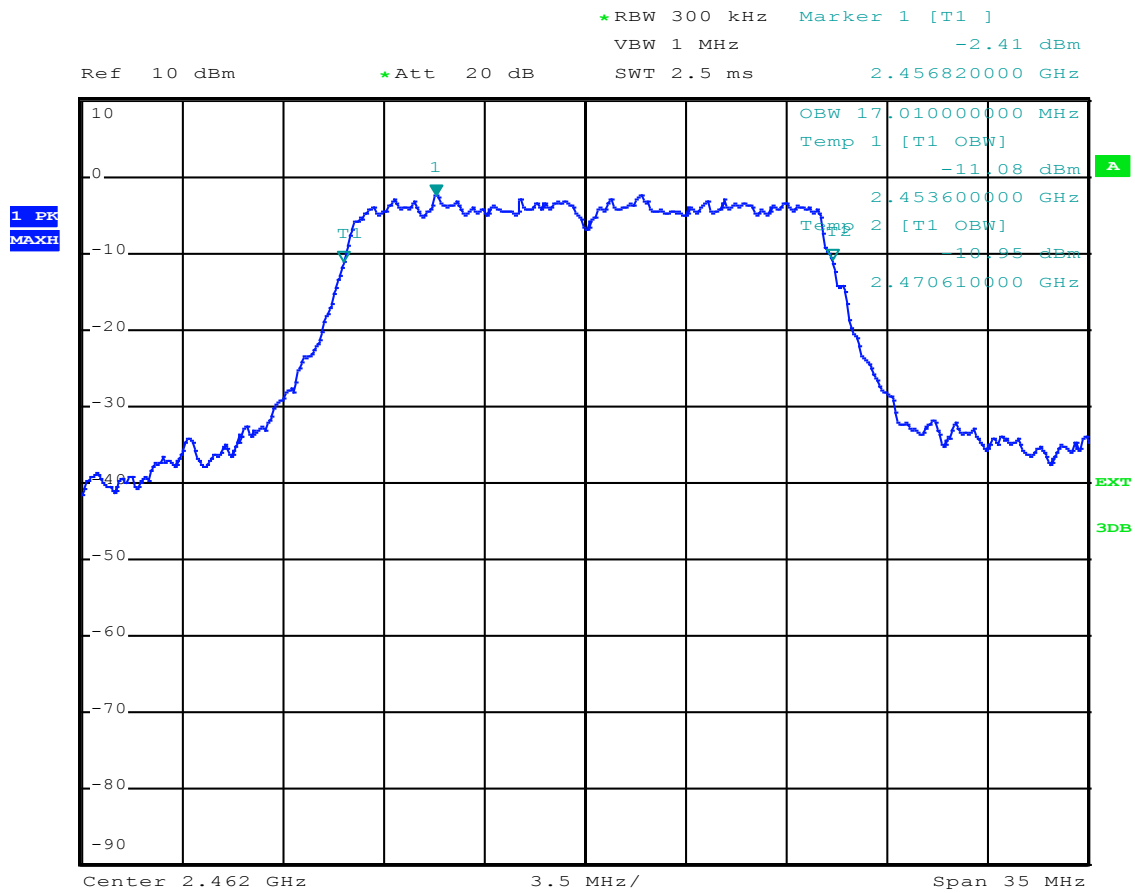
Low Channel – 802.11.g



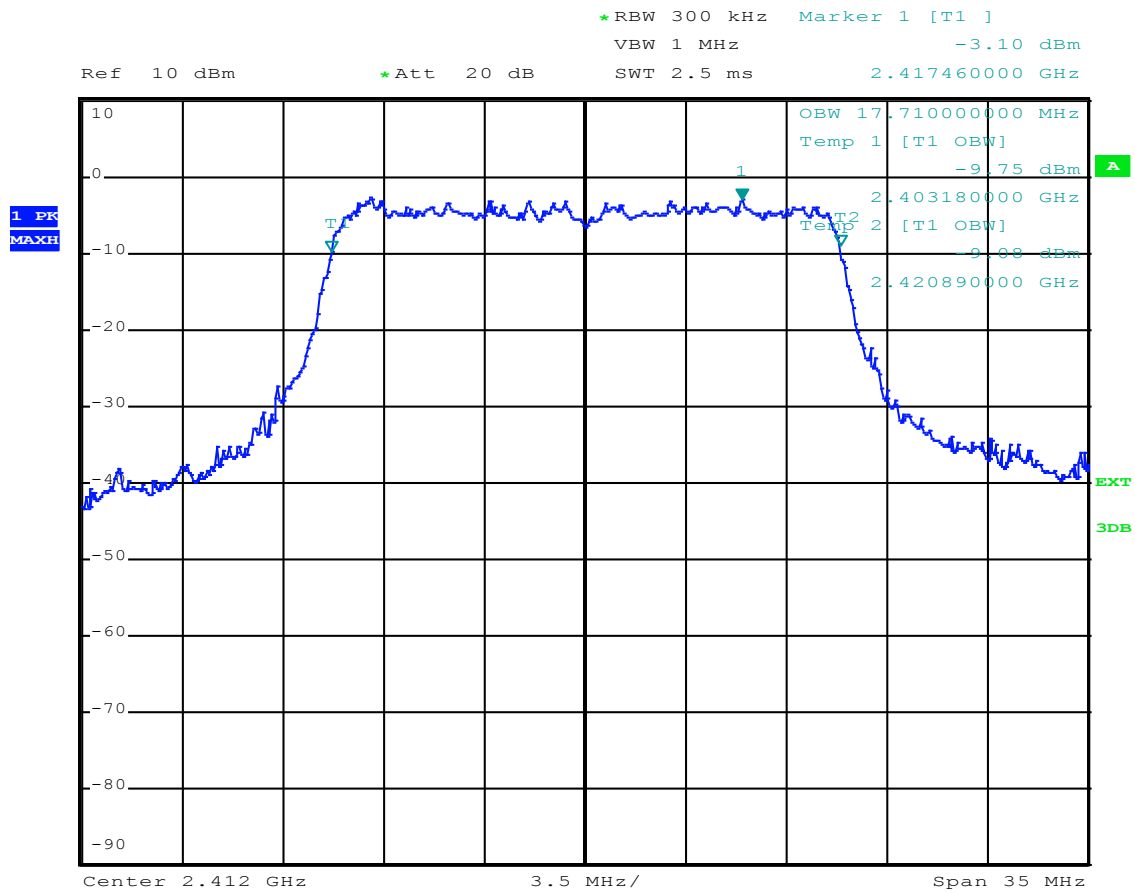
Central Channel – 802.11.g



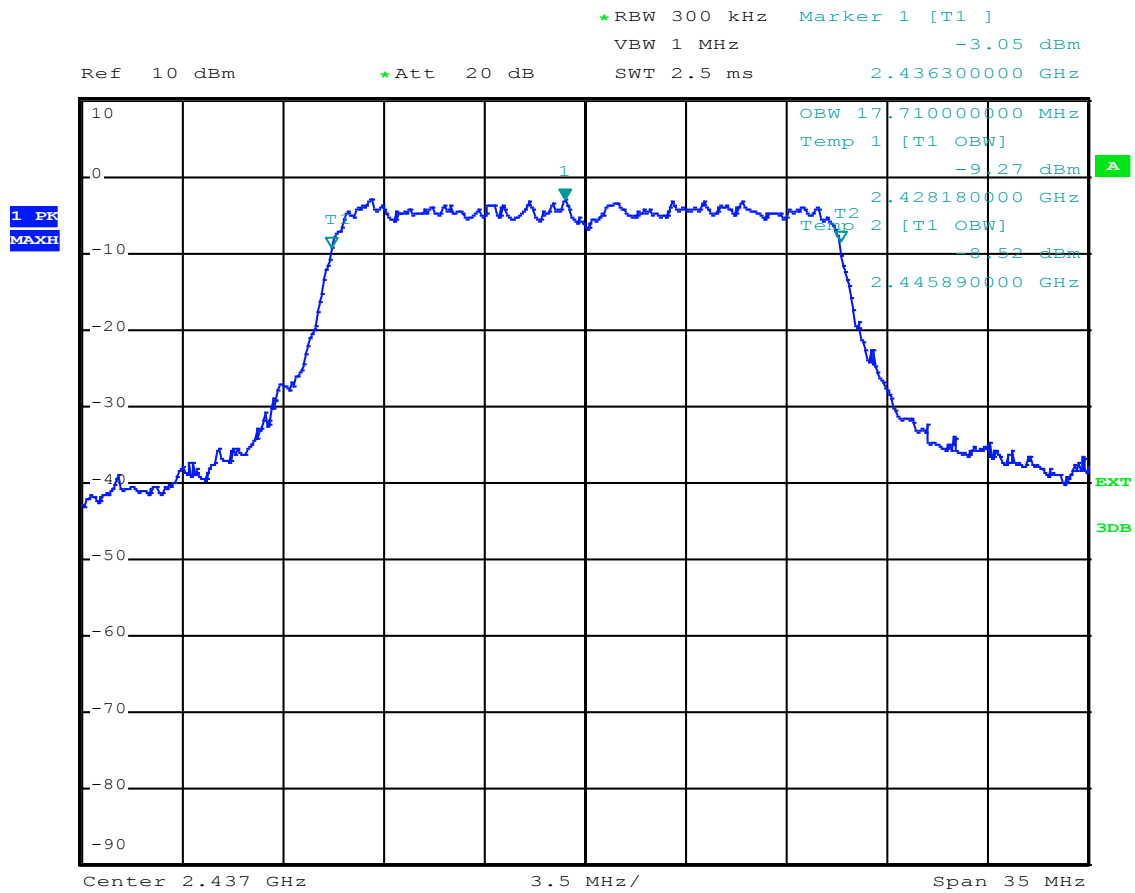
High Channel – 802.11.g



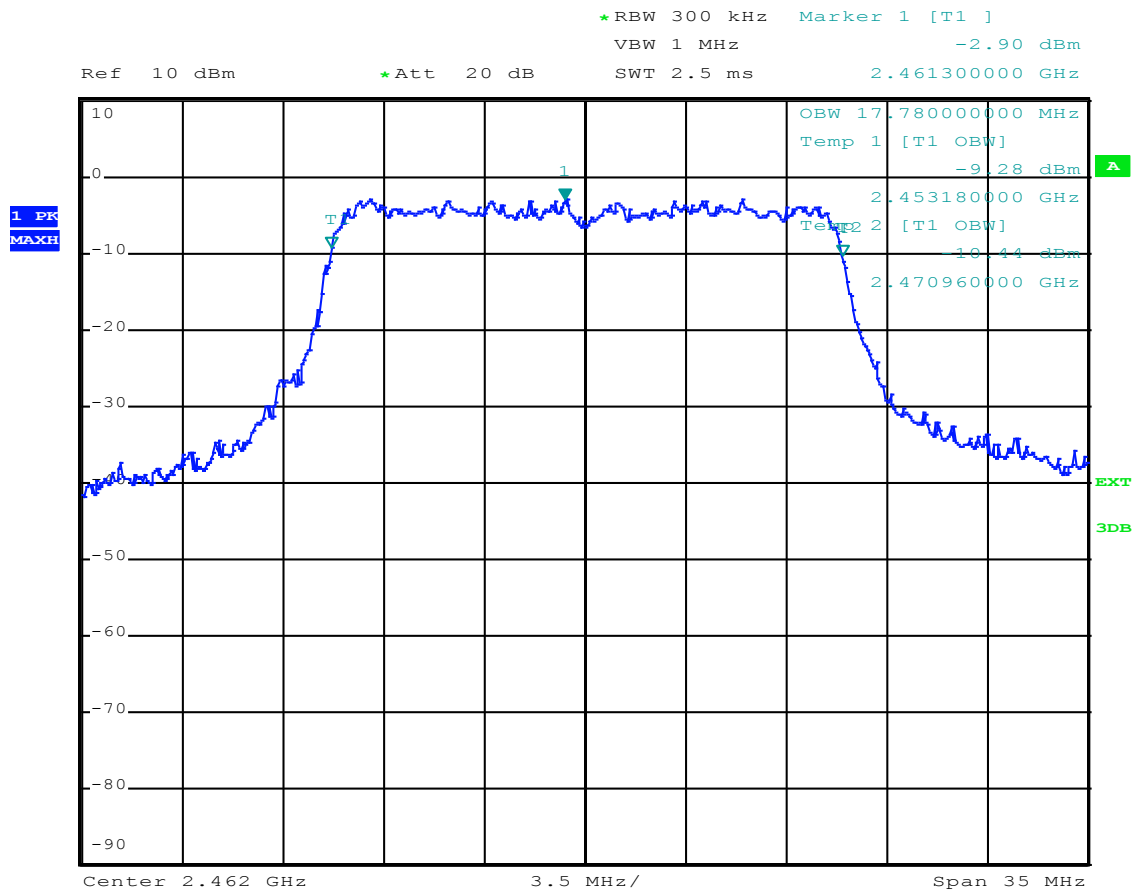
Low Channel – 802.11.n – 20MHz



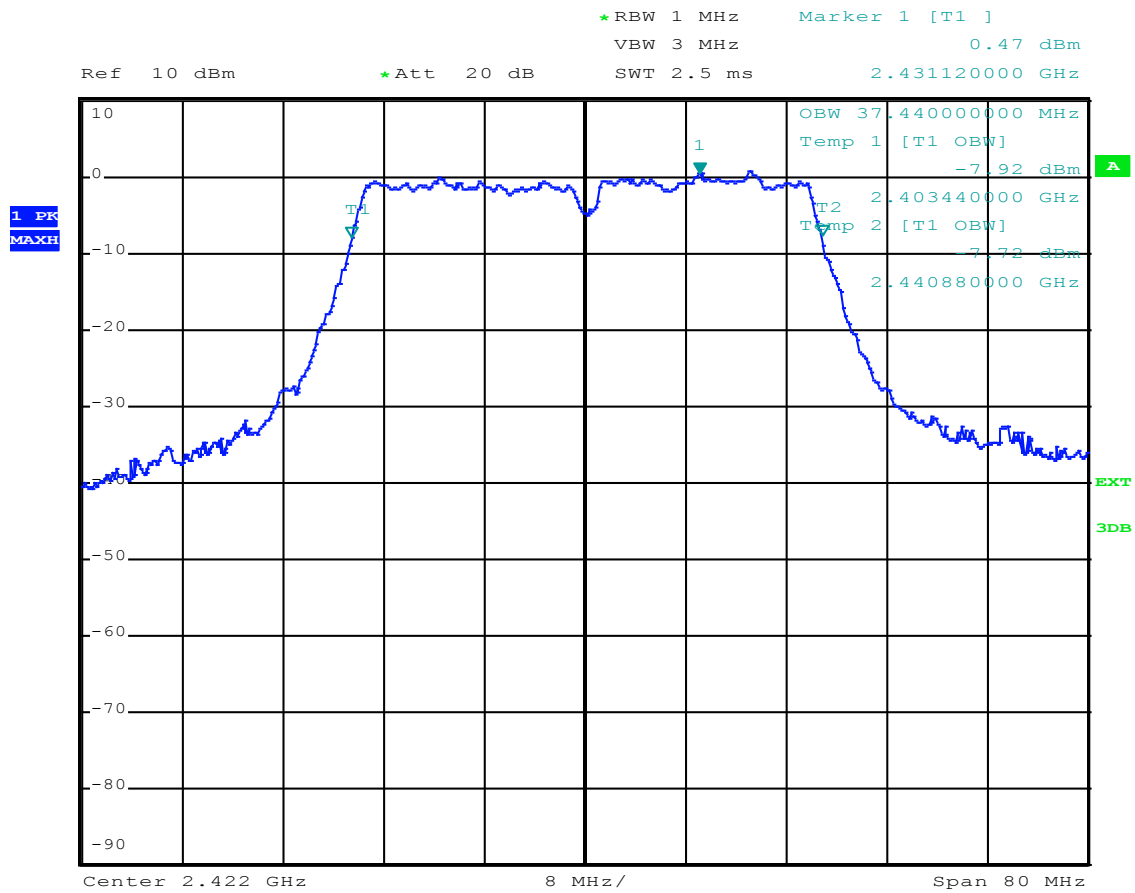
Central Channel – 802.11.n – 20MHz



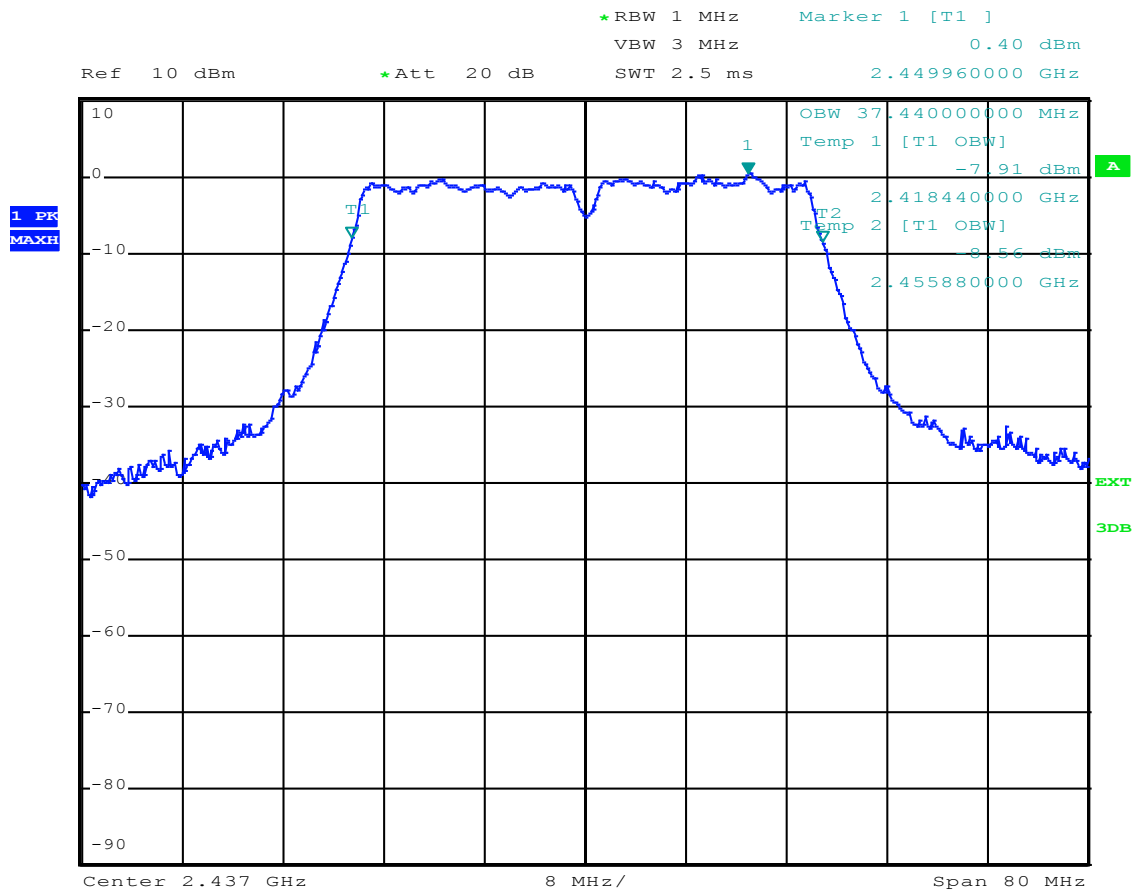
High Channel – 802.11.n – 20MHz



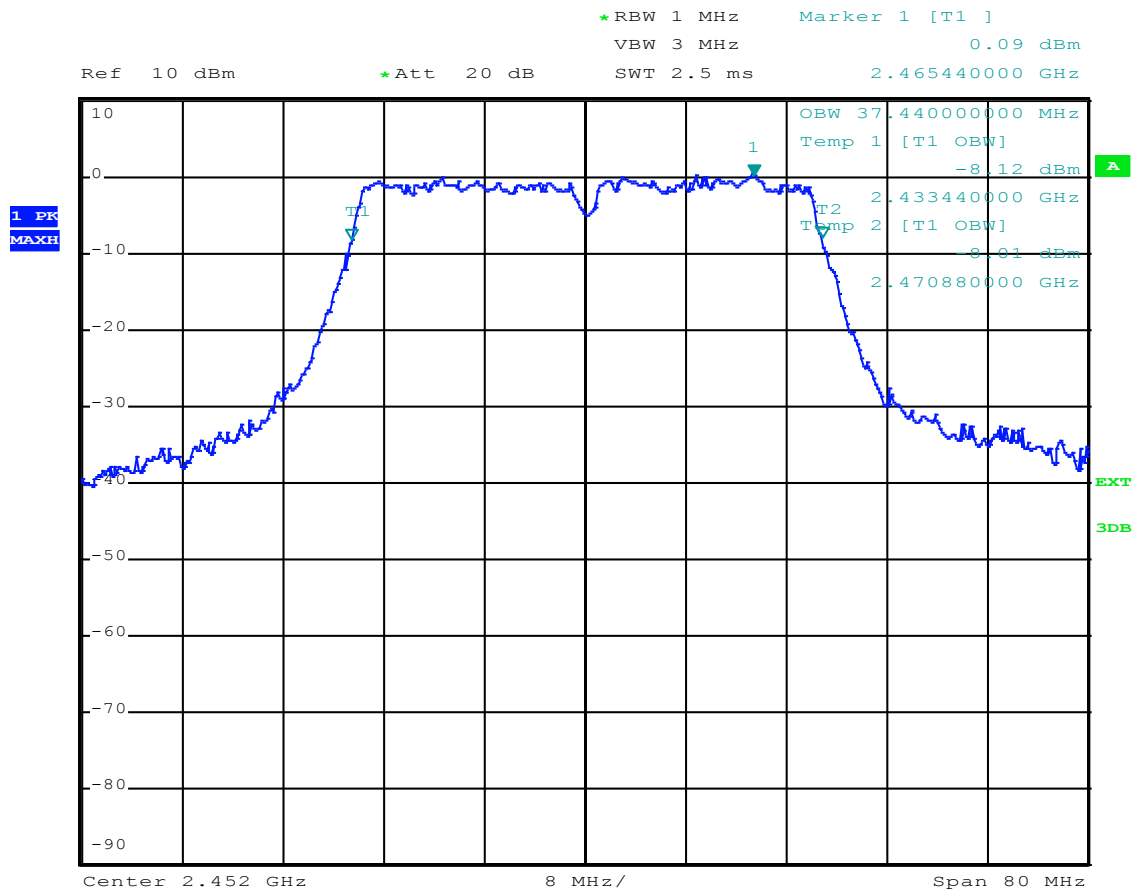
Low Channel – 802.11.n – 40MHz



Central Channel – 802.11.n – 40MHz

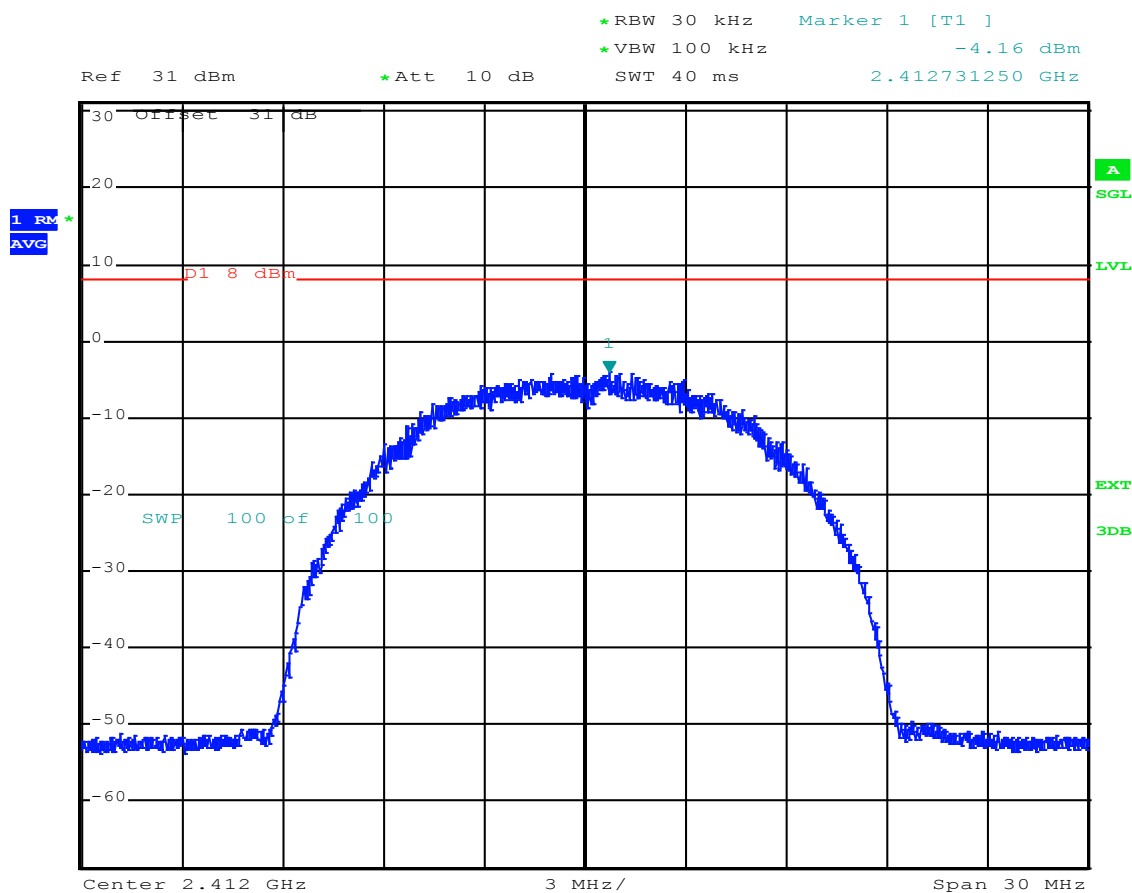


High Channel – 802.11.n – 40MHz

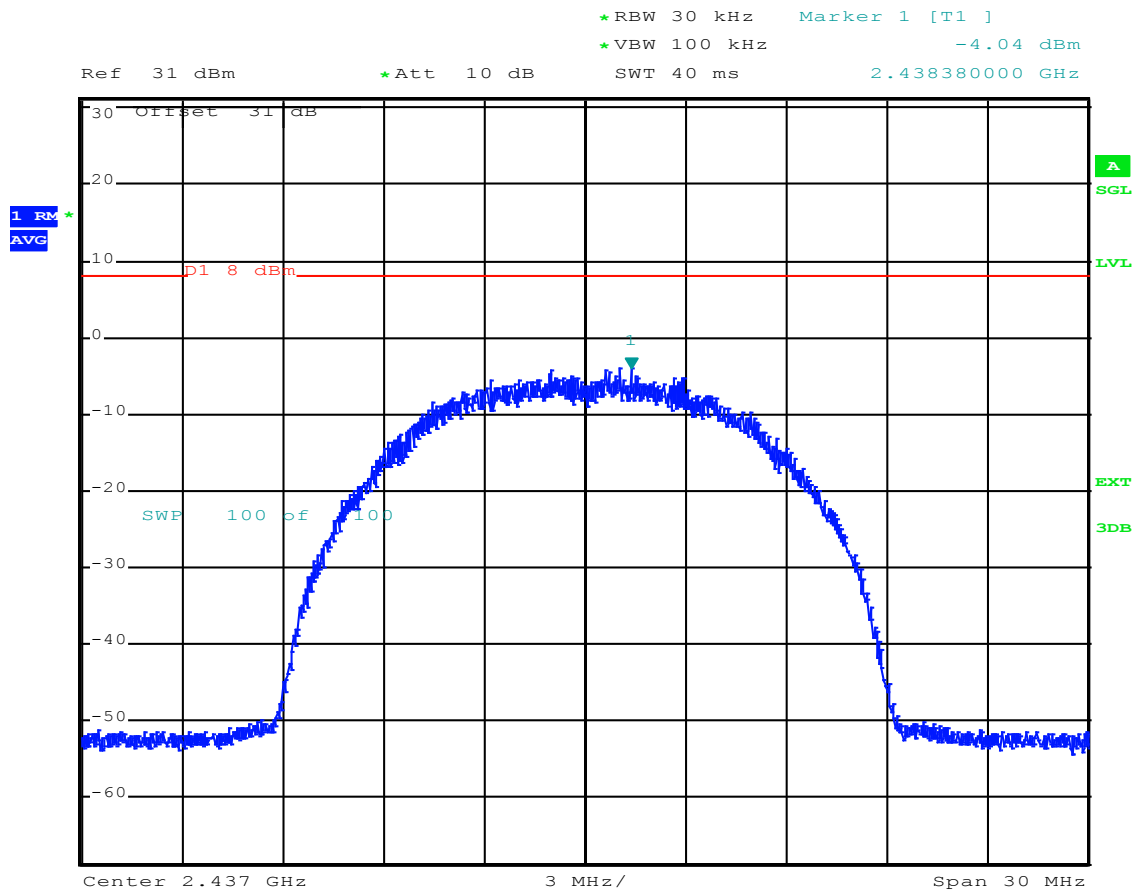


APPENDIX 4: Radiated Spectral density

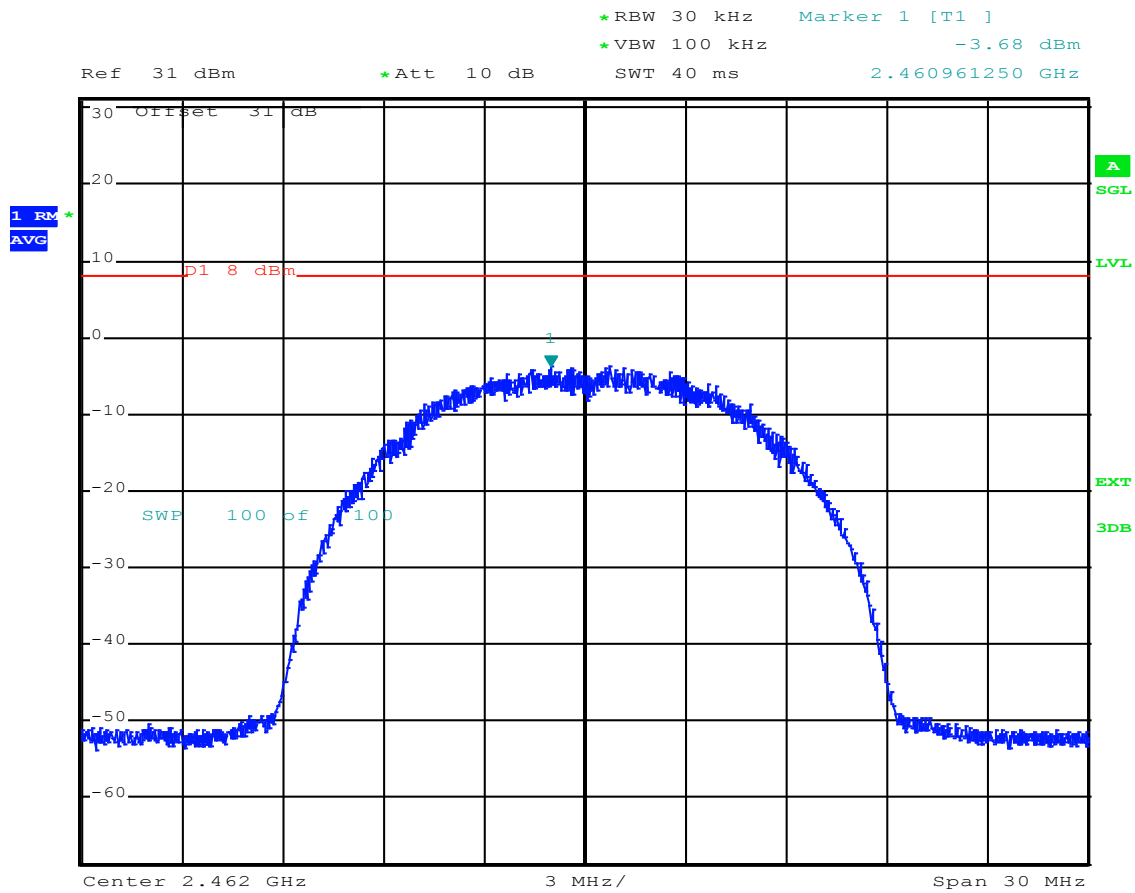
Low Channel – 802.11.b



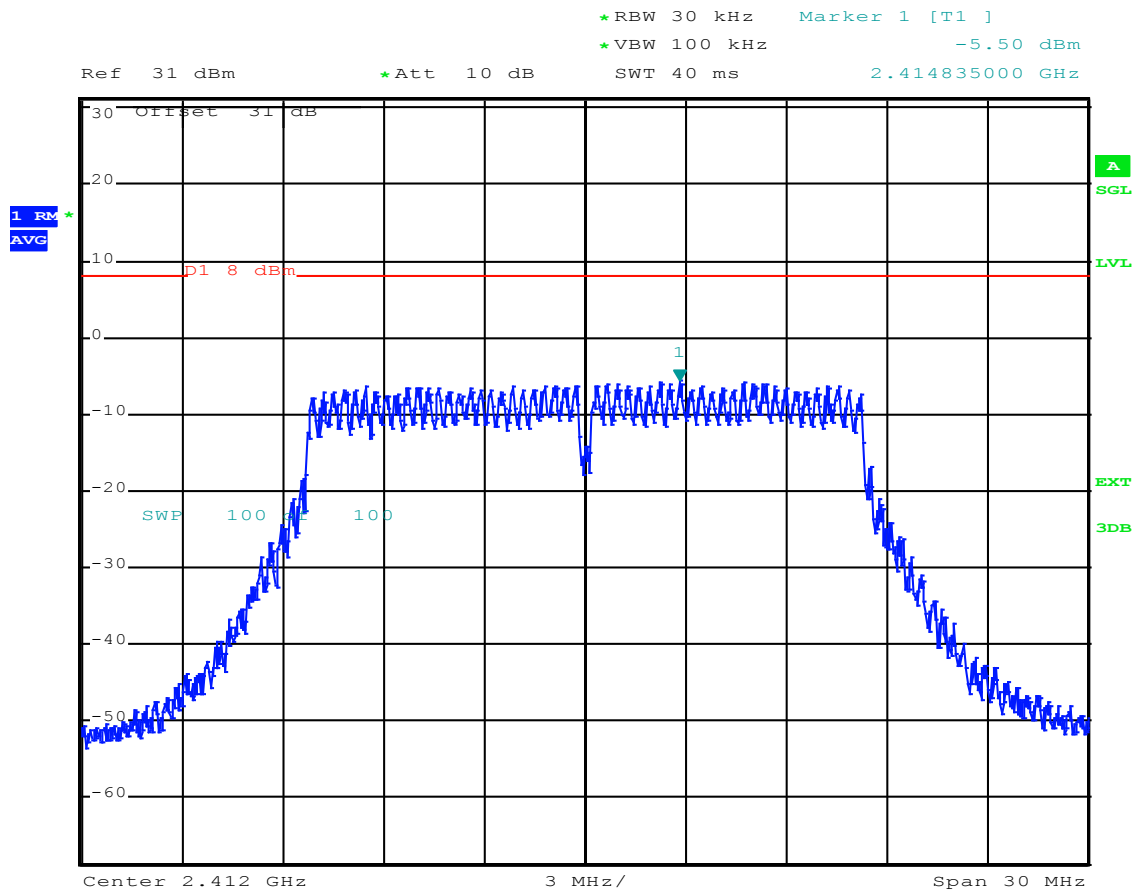
Central Channel – 802.11.b



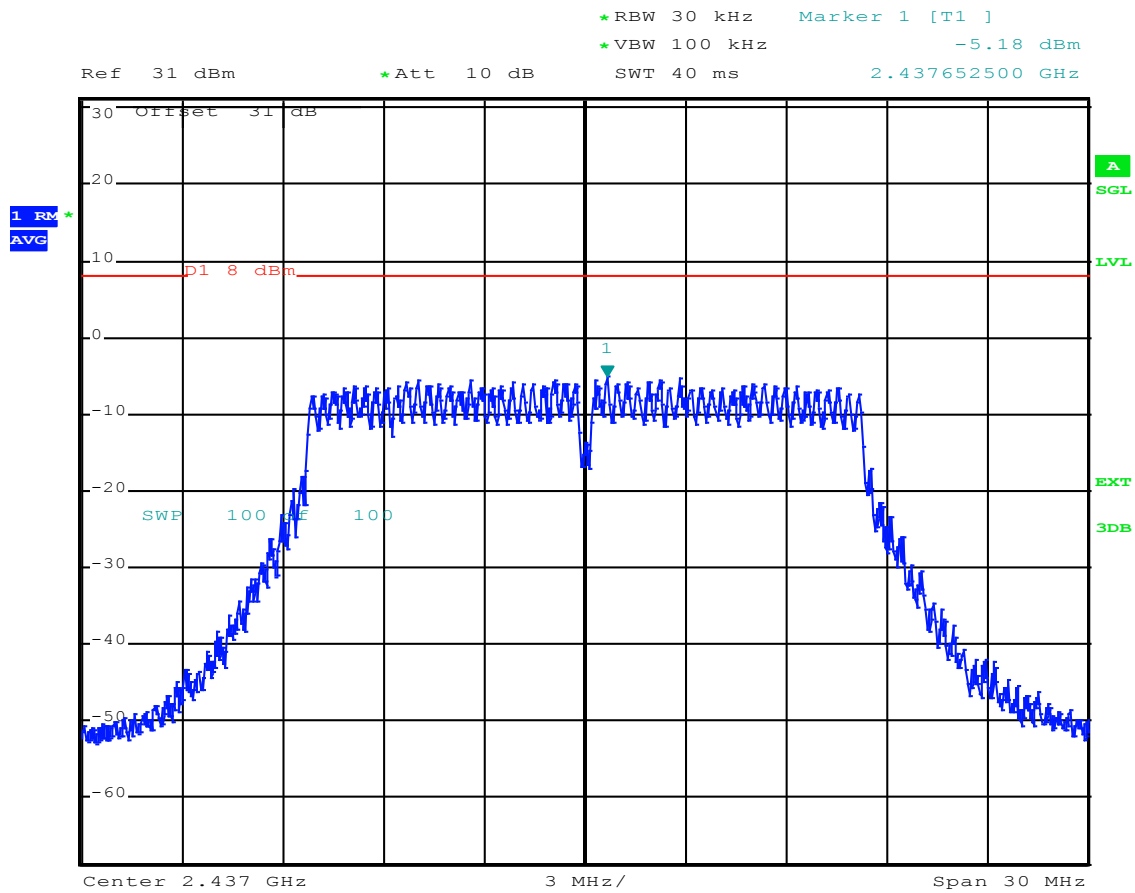
High Channel – 802.11.b



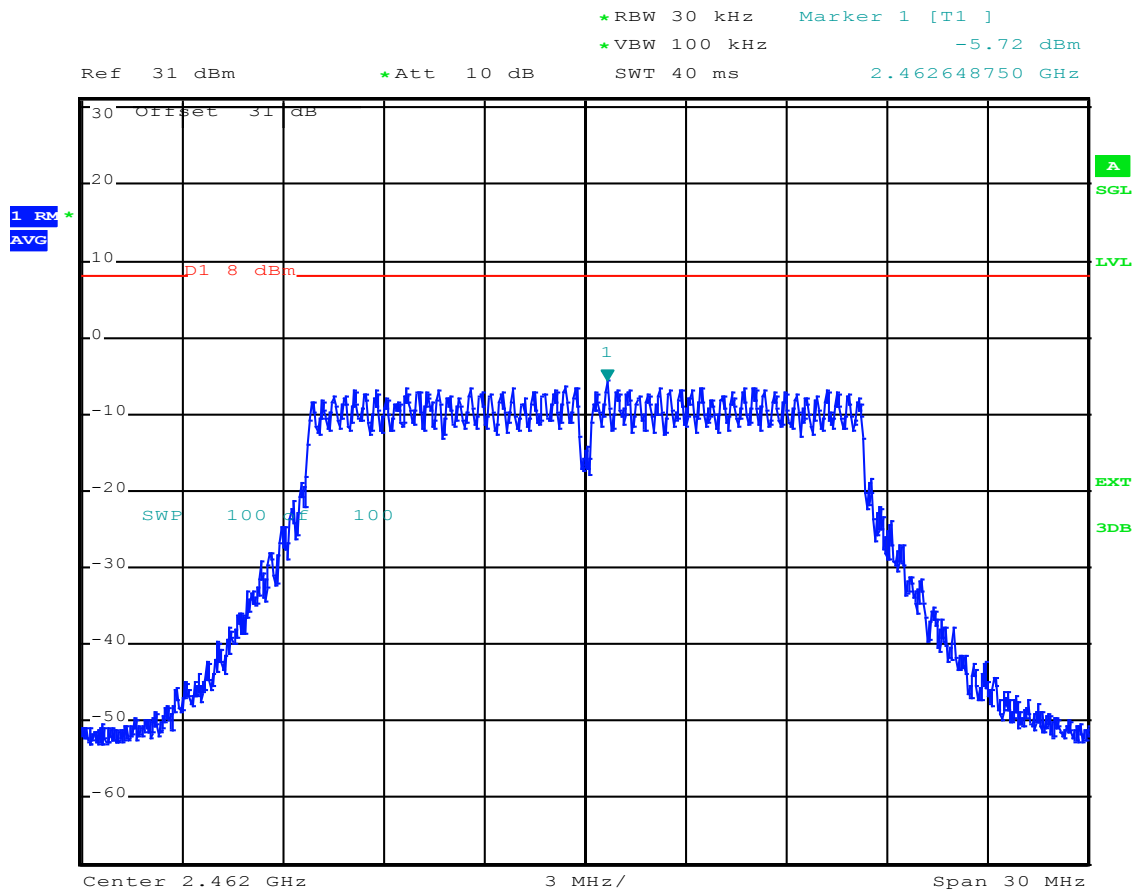
Low Channel – 802.11.g



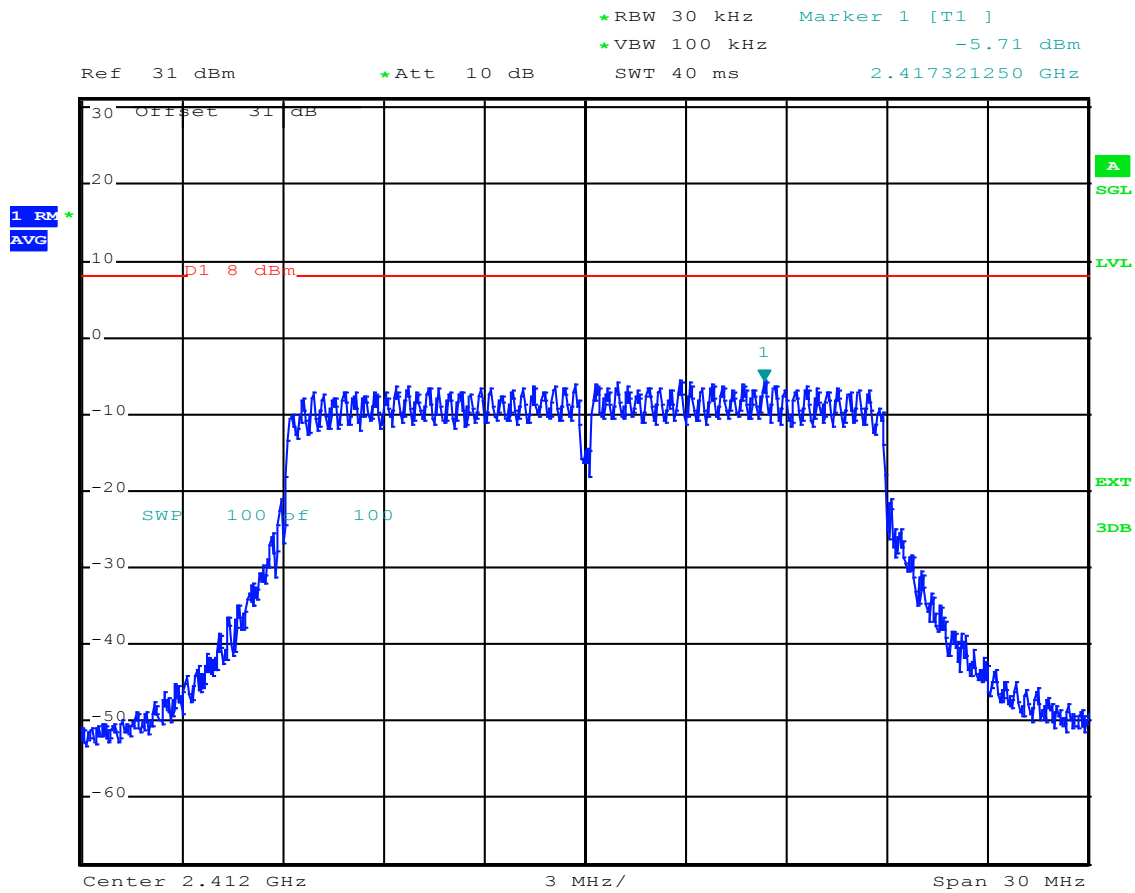
Central Channel – 802.11.g



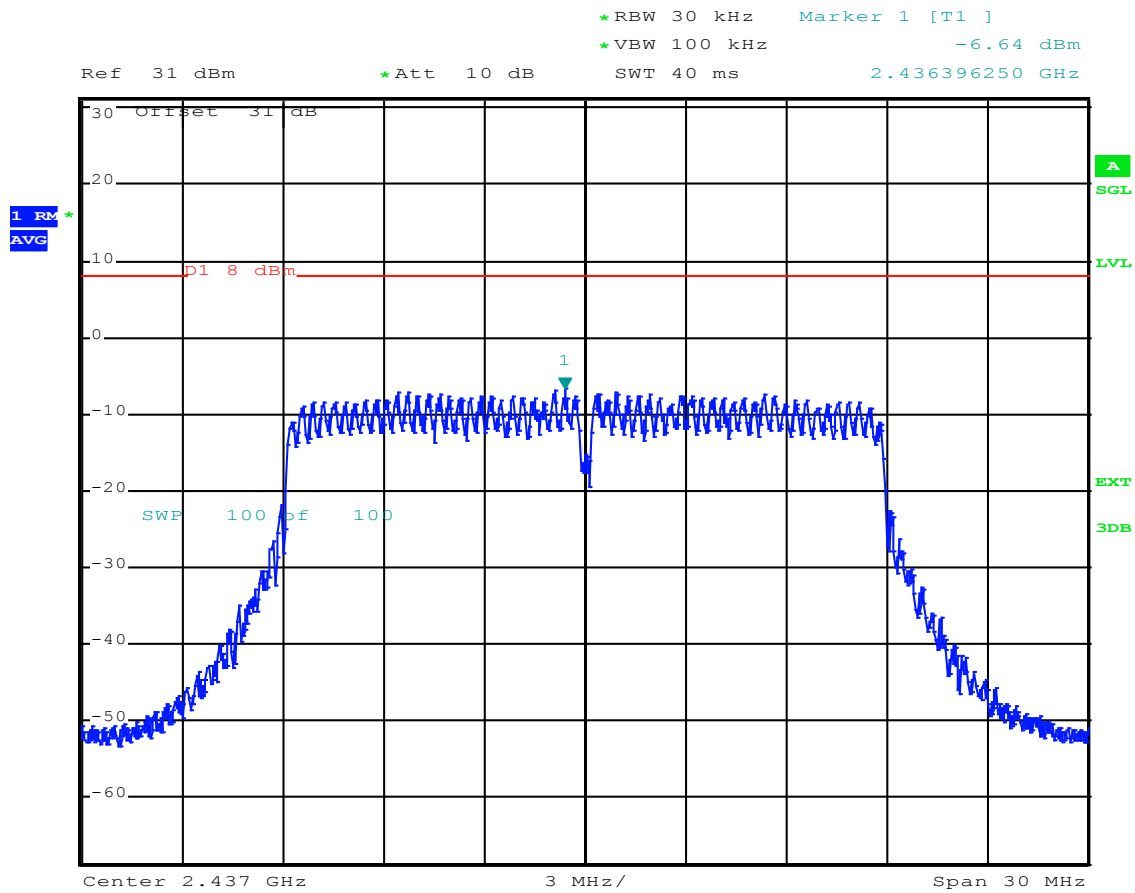
High Channel – 802.11.g



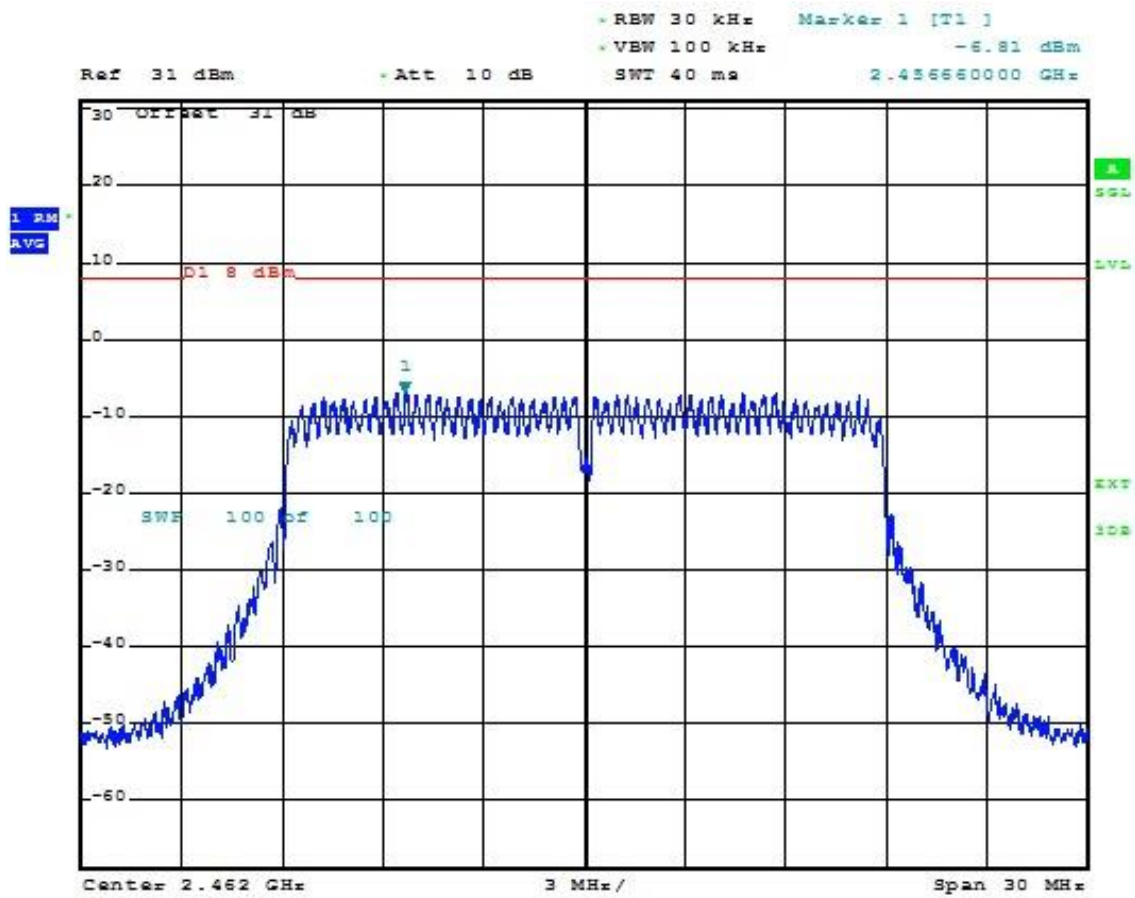
Low Channel – 802.11.n – BW 20MHz



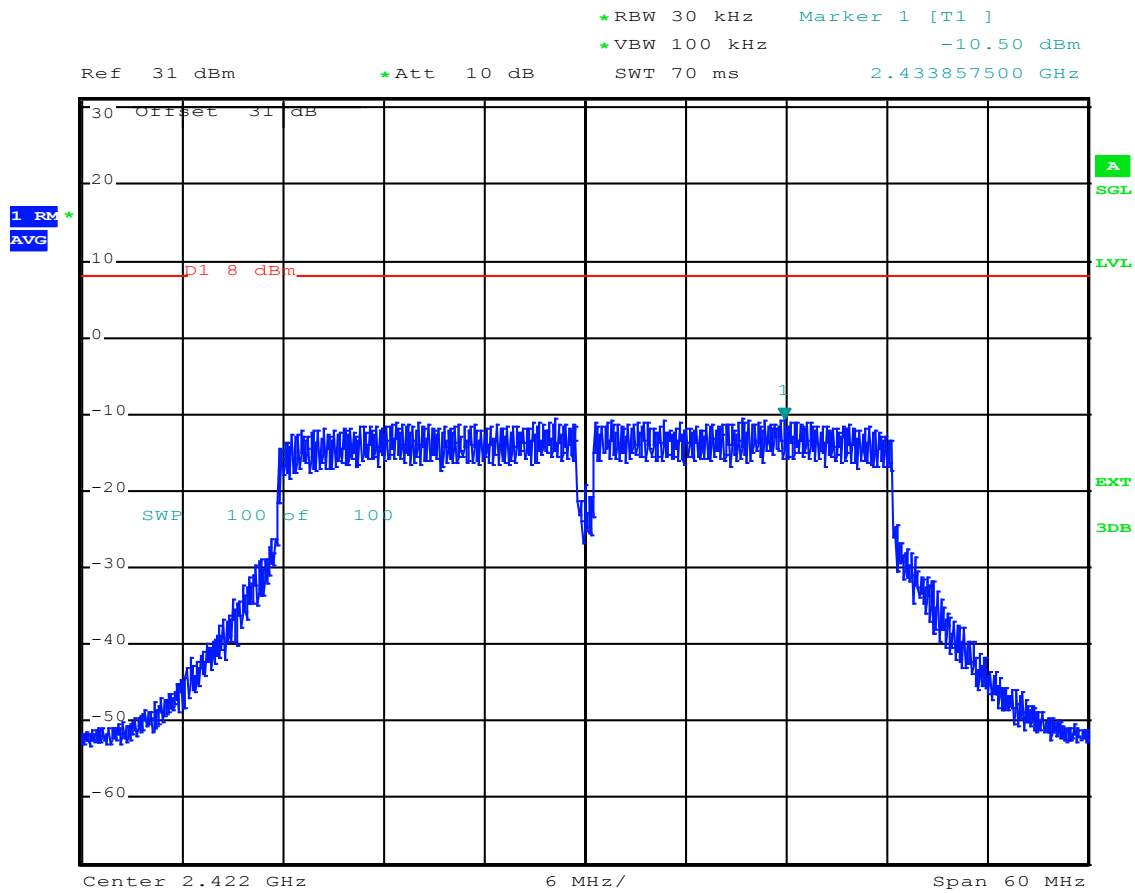
Central Channel – 802.11.n – BW 20MHz



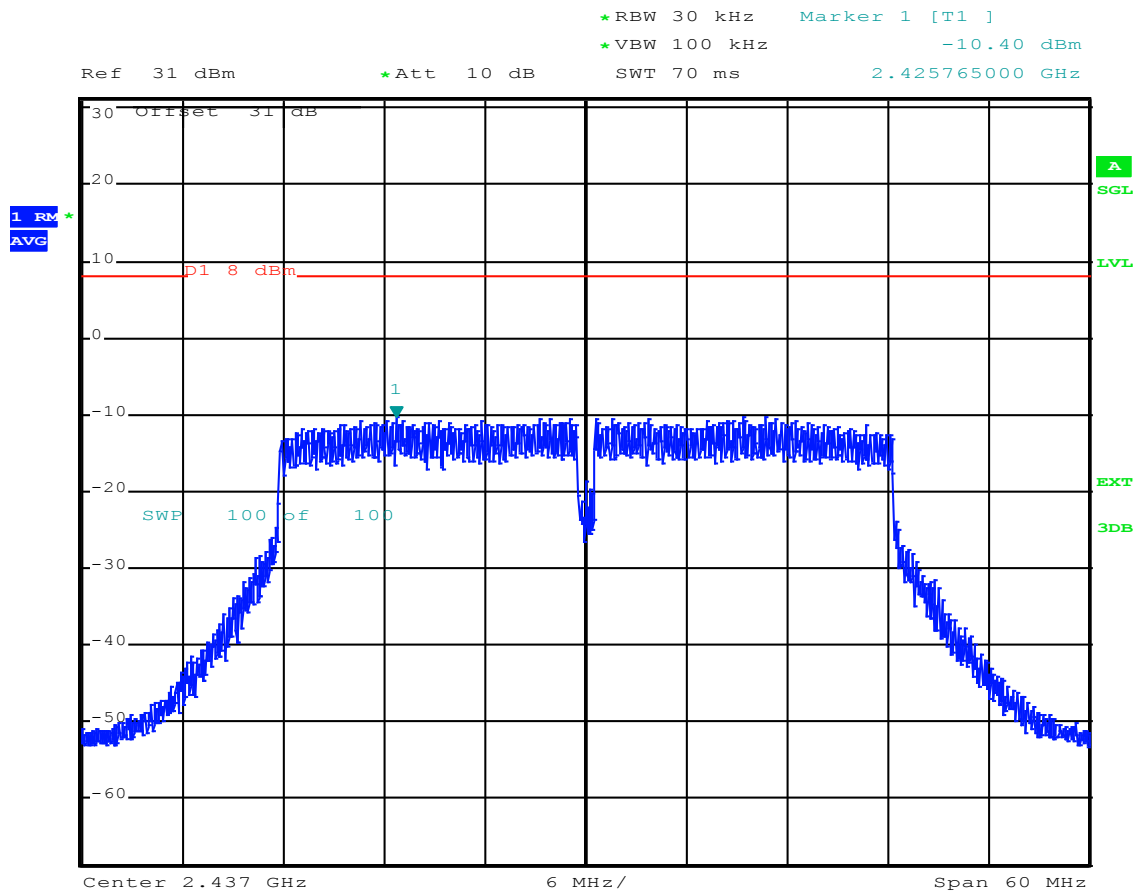
High Channel – 802.11.n – BW 20MHz



Low Channel – 802.11.n – BW 40MHz



Central Channel – 802.11.n – BW 40MHz



High Channel – 802.11.n – BW 40MHz

