

RRA-EMIESS24C779SMA-04Av0

Certification Radio test report

According to the standard:

CFR 47 FCC PART 15

RSS GEN – Issue 5

RSS 247 – Issue 3

Equipment under test:

COLD LOCATION TRACKER – LC04

FCC ID: 2BLRQLC03LC042K24

Company:

SMADE

Distribution: Mr ANDRE Sébastien

(Company: SMADE)

Number of pages: 53 with 2 annexes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval	
			Name and Function	Visa
0	28-Jan-25	Creation	J.C. BOGA, Laboratories Manager	

Duplication of this document is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.

This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.

Information in italics are declared by the manufacturer/customer and are under his responsibility

DESIGNATION OF PRODUCT: *COLD LOCATION TRACKER – LC04*

Serial number (S/N): Radiated sample: *LC0405-2350-002345*
Conducted sample: *LC0405-2350-002346*

Reference / model (P/N): *LC03 and LC04*

Firmware version: *ATM: 1.16.0 / NRF: 1.19.3 / ESP:1.0.0*

MANUFACTURER: *SMADE*

COMPANY SUBMITTING THE PRODUCT:

Company: SMADE

Address: 77 boulevard de Stalingrad,
69100 Villeurbanne,
FRANCE

Responsible: Mr ANDRE Sébastien

Person(s) present during the tests: Mr VINCENT Benjamin (First day)
Mr RAQIOUI Abdessamad (second day)
Mr PRESUMEY Yannick (Third day)

DATE(S) OF TEST: From 16-Jul-24 to 18-Jul-24

TESTING LOCATION: EMITECH LYON laboratory at CHASSIEU (69) FRANCE

FCC Accredited under US-EU MRA Designation Number: FR0013
Test Firm Registration Number: 807590

ISED Accredited under CANADA-EU MRA Designation Number: FR0007
Industry Canada Registration Number: 4379D

TESTED BY: T. LEDRESSEUR

VISA:



WRITTEN BY: T. LEDRESSEUR

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REVISIONS HISTORY

Revision	Date	Modified pages	Modifications
0	28-Jul-24	/	Creation

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **LC04**, in accordance with normative reference.

The equipment under test integrates:

- LTE-M,transceiver radio module already certified, (NRF9160)
- WiFi 2.4 GHz transceiver radio function not already certified,

This report concerns only WiFi radio part.

2. PRODUCT DESCRIPTION

Class:	B
Antenna type and gain:	3.8 dBi / ¼-wave integral antenna
Operating frequency range:	From 2412 MHz to 2462 MHz
Number of channels:	11
Channel spacing:	5 MHz
Channel bandwidth:	20 MHz
Modulation:	DBPSK OFDM: BPSK OFDM: 64-QAM
Mode tested:	802.11b 802.11g 802.11n
Data rate tested:	For 802.11b: 1Mbit/s For 802.11g: 6Mbit/s For 802.11n: MCS0
Channel tested:	Channel 1: 2412 MHz Channel 6: 2437 MHz Channel 11: 2462 MHz
Correlated signal:	The product possess only 1 antenna (SISO)
Power source:	Internal battery 3.6 Vdc

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 (2024)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for Compliance Testing of Unlicensed Wireless Devices.
558074 D01 15.247	Meas Guidance v05r02 Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
RSP-100	Issue 12, August 2019 Certification of Radio Apparatus and Broadcasting equipment
RSS-Gen	Issue 5, April 2018 General Requirements for Compliance of Radio Apparatus
RSS-247	Issue 3, August 2023 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) 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 209: Radiated emission limits; general requirements
- 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

Radio performance tests procedures given in RSS-Gen:

- Paragraph 2 - General
- Paragraph 3 - Normative publications and related documents
- Paragraph 4 - Labelling requirements
- Paragraph 6 - General administrative and technical requirements
- Paragraph 8 - Licence-exempt Radio Apparatus

Radio performance tests procedures given in RSS-247:

- Paragraph 3 - Certification requirements
- Paragraph 4 - Measurement method
- Paragraph 5 - Standard specifications for frequency hopping systems and digital transmission systems operating in 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 V3.18.0.26	Software	/	/	/
5609	EMCO 3146A	Log periodic antenna	14/12/2021	3	14/12/2024
6118	Rohde et Schwarz HK116	Biconical antenna	14/12/2021	3	14/12/2024
6970	Schwarzbeck BBHA 9120D	Antenna	16/12/2021	3	16/12/2025
7564	La Crosse Technology WS-9232	Meteo station	09/08/2022	2	09/08/2024
7651	SIDT Cage	Anechoic chamber	/	/	/
10262	Agilent Technologies 8449B	Low-noise amplifier	27/02/2024	1	27/02/2025
11588	Rohde et Schwarz NRV-Z86	Power Sensor	07/03/2024	2	07/03/2026
12492	Weinschel 10dB 18GHz 2W	Attenuator	26/02/2024	3	26/02/2027
14037	Microtronics HPM15162	High-pass filter	20/10/2021	3	20/10/2024
14522	Huber + Suhner k-1m	Cable	29/01/2024	2	29/01/2026
14690	ETS lindgren 3160-09	Antenna	07/01/2022	3	07/01/2025
14851	Wright Technologie ASL40-B3015	Low-noise amplifier	29/01/2024	2	29/01/2026
14887	JYE BAO k-15cm	Cable	29/01/2024	2	29/01/2026
15775	RFPA INT-BA011000-25	Low-noise amplifier	29/02/2024	1	29/02/2025
15776	Rohde & Schwarz FSV40	Spectrum Analyzer	22/02/2024	1	22/02/2025
15790	Testo 608-H1	Meteo station	20/11/2023	1	20/11/2024
15892	HUBER et SUHNER N 18GHz 3m	Cable	31/05/2023	2	31/05/2025
15893	HUBER et SUHNER SMA 18GHz 3m	Cable	31/05/2023	2	31/05/2025
15916	HUBER et SUHNER SMA 18GHz 3.5m	Cable	31/05/2023	2	31/05/2025
15933	HUBER et SUHNER SMA 18GHz 5m	Cable	31/05/2023	2	31/05/2025
19114	Fluke 177	Multimeter	22/06/2023	2	22/06/2025
///	Rohde et Schwarz Power Viewer Plus V5.9	Software	/	/	/

6. TESTS RESULTS SUMMARY

6.1 CFR 47 part 15 requirements

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				Note 3
	(b) Unwanted emissions outside of §15.247 frequency bands	X				
	(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				
	(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.

6.2 RSS-247 requirements

Test Procedure RSS-247	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
Paragraph 5	Standard specifications for frequency hopping system and digital transmission systems operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
5.1	Frequency hopping systems (FHSS)			X		
5.2	Digital transmission systems	X				
5.3	Hybrid systems			X		
5.4	Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) requirements	X				
5.5	Unwanted emissions	X				

NAp: Not Applicable

NAs: Not Asked

7. MEASUREMENT UNCERTAINTY

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s)

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	$\pm 0.8\text{dB}$
Radiated emission valid to 26 GHz	
9kHz – 30MHz	$\pm 2.7\text{ dB}$
30MHz – 1GHz	$\pm 5.0\text{ dB}$
1GHz – 18GHz	$\pm 5.3\text{ dB}$
18GHz – 40GHz	$\pm 6.1\text{ dB}$
AC Power Lines conducted emissions	$\pm 3.4\text{ dB}$
Temperature	$\pm 1\text{ }^{\circ}\text{C}$
Humidity	$\pm 5\%$

8. OCCUPIED BANDWIDTH

Temperature (°C) : 27

Humidity (%HR): 38

Date : July 16, 2024

Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247

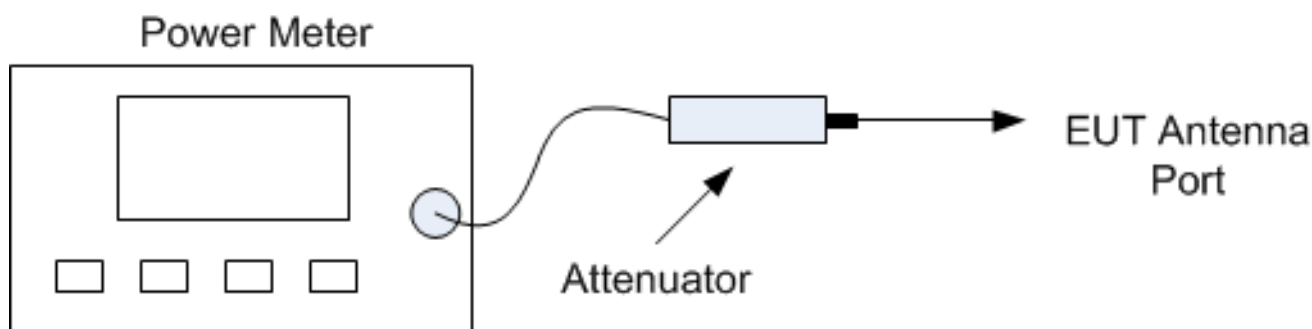
Test procedure:

Method of paragraphs 11.8 of ANSI C63.10 (6dB Measurement)

Method of paragraphs 6.9.3 of ANSI C63.10 (99% Measurement)

Test set up:

Conducted test



Setting:

Measure	6dB	99%
Center frequency	The centre frequency of the channel under test	
Detector	Peak	
Span	2 to 5 times the OBW	1.5 to 5 times the OBW
RBW	100kHz	1% to 5% of the OBW
VBW	300kHz	3 x RBW
Trace	Max hold	
Sweep	Auto	

Test operating condition of the equipment:

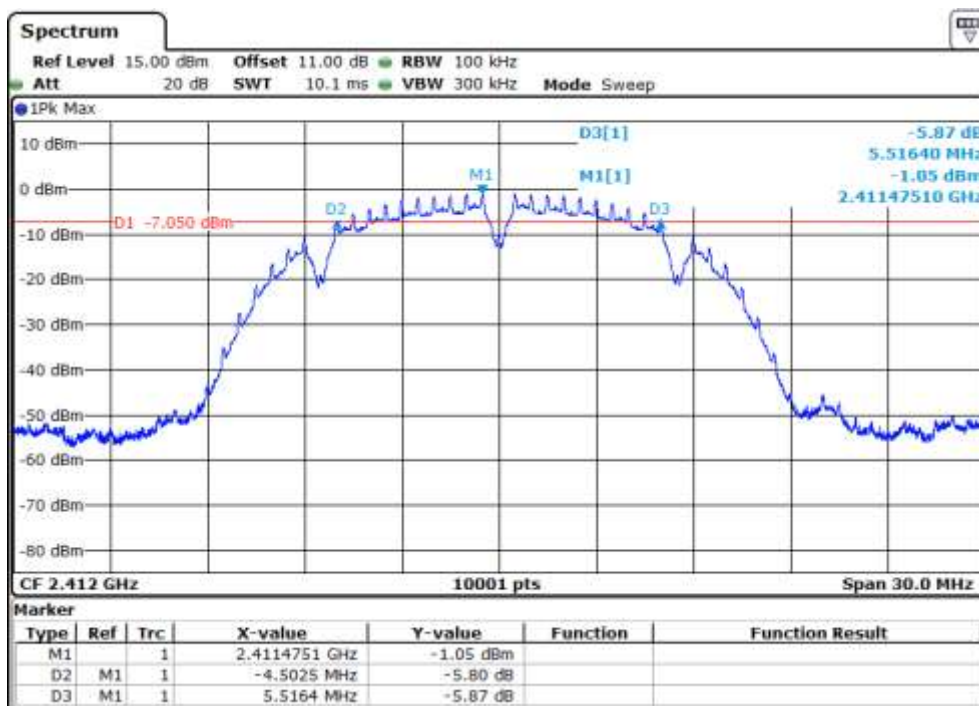
The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

We used for power source the internal fully charged battery of the equipment:

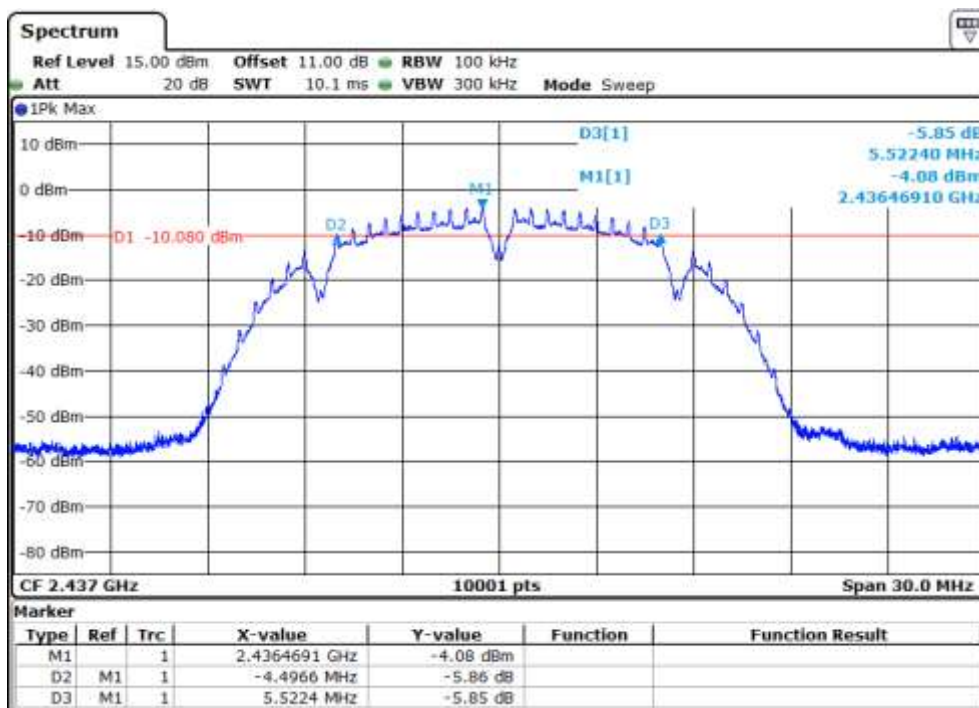
Results:

Sample N° 1: Measure of 6dB bandwidth

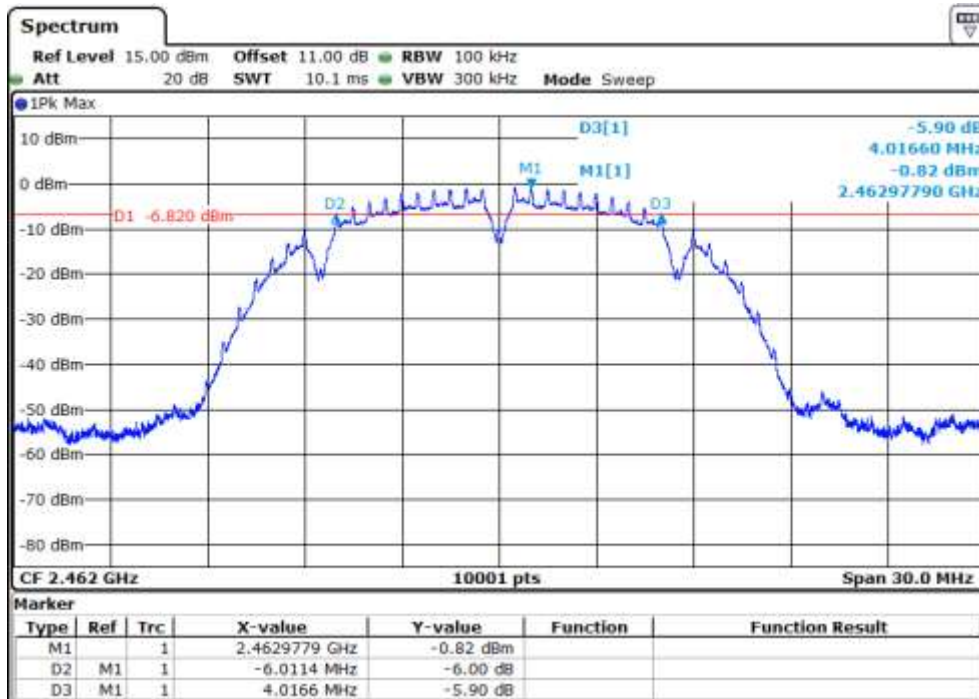
Channel 1 (F = 2412 MHz) – Mode 802.11b – bandwidth 20 MHz



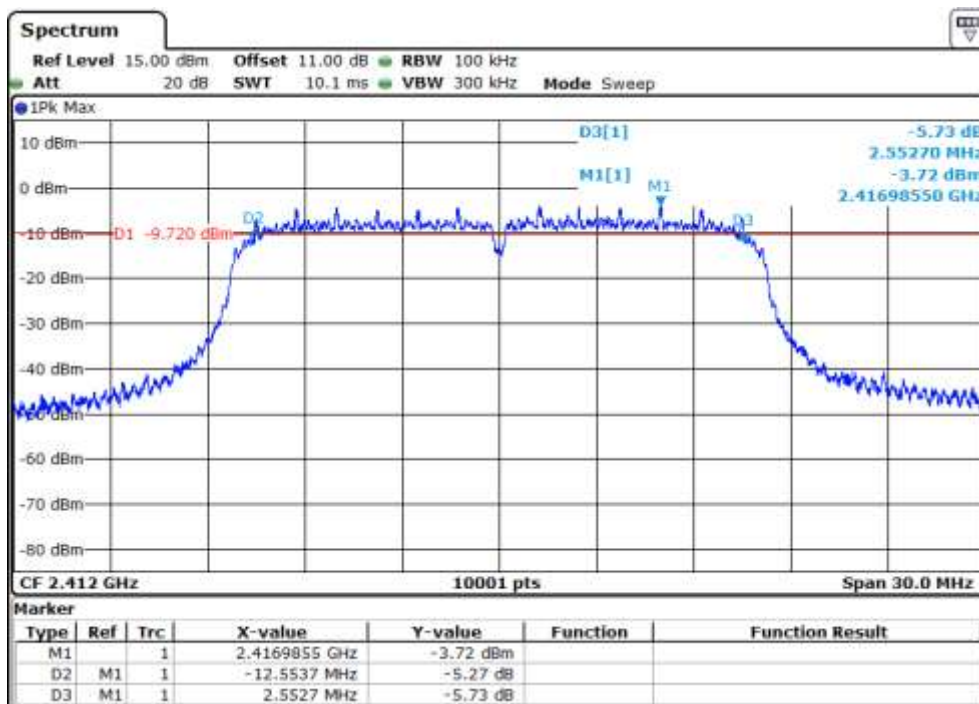
Channel 6 (F = 2437 MHz) – Mode 802.11b – bandwidth 20 MHz



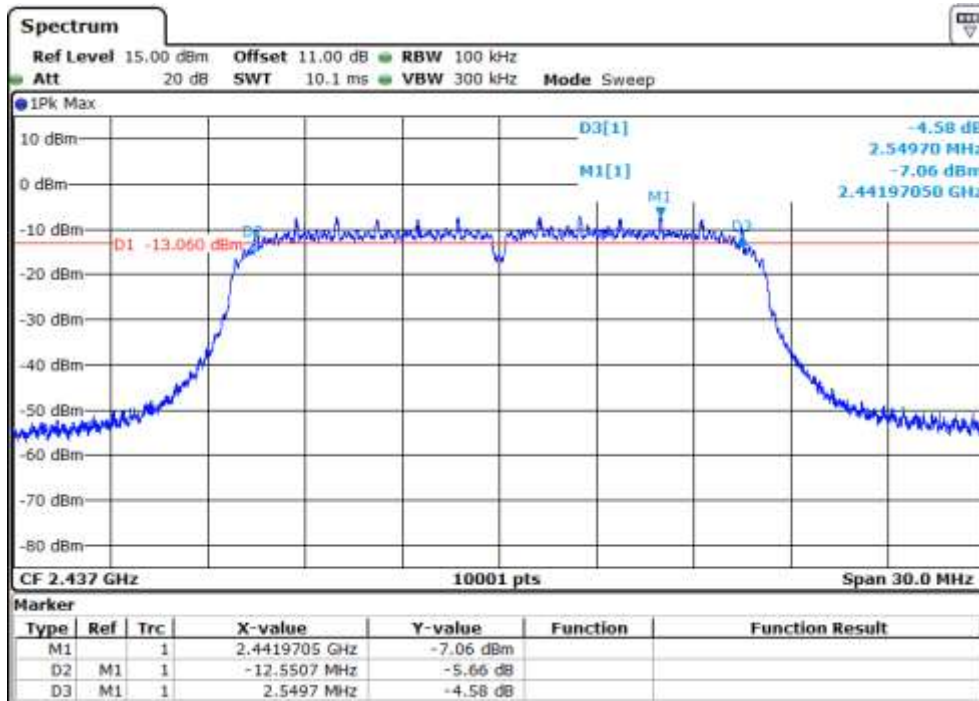
Channel 11 (F = 2462 MHz) – Mode 802.11b – bandwidth 20 MHz



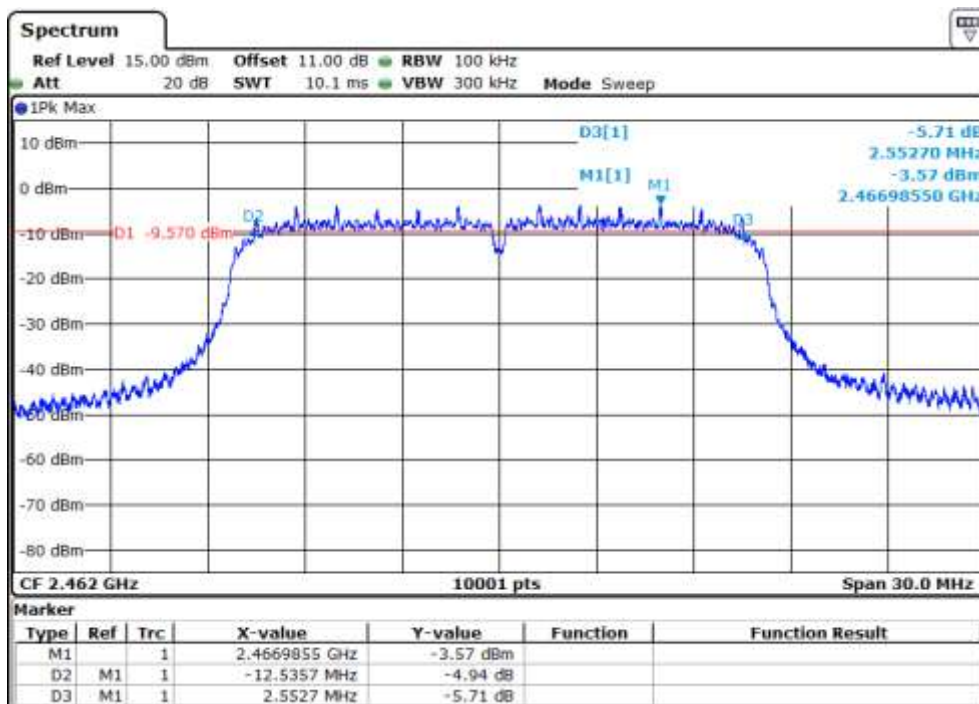
Channel 1 (F = 2412 MHz) – Mode 802.11g – bandwidth 20 MHz



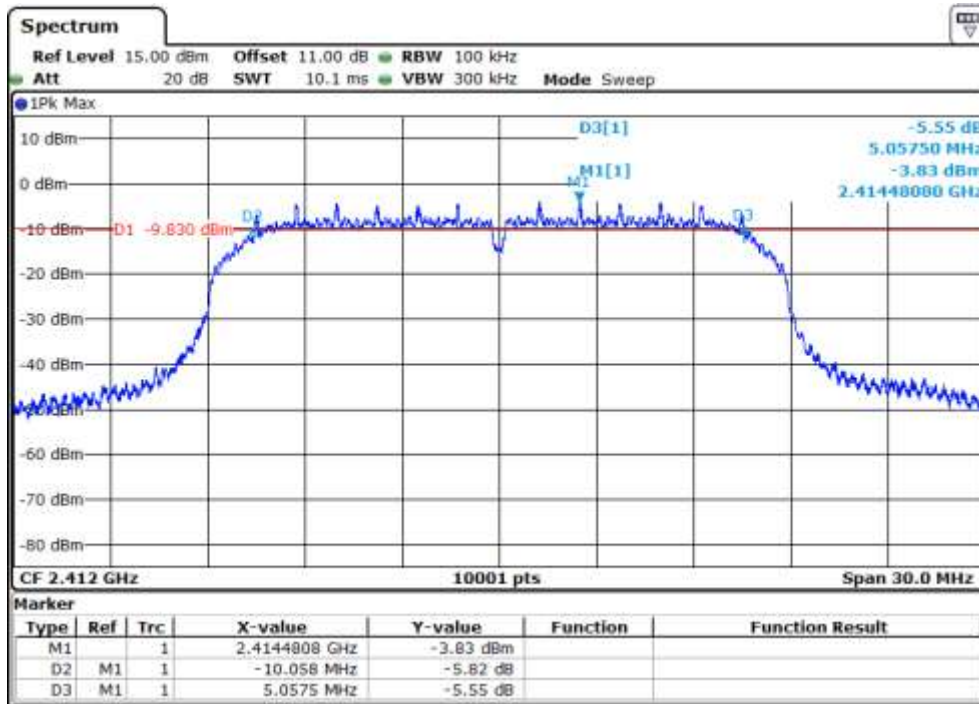
Channel 6 (F = 2437 MHz) – Mode 802.11g – bandwidth 20 MHz



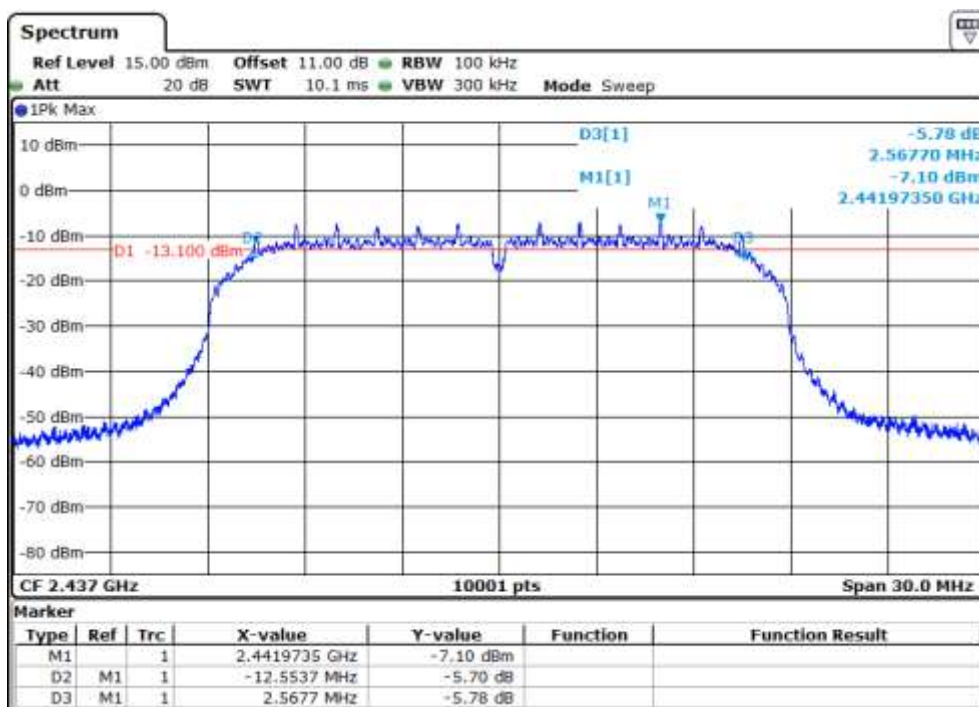
Channel 11 (F = 2462 MHz) – Mode 802.11g – bandwidth 20 MHz



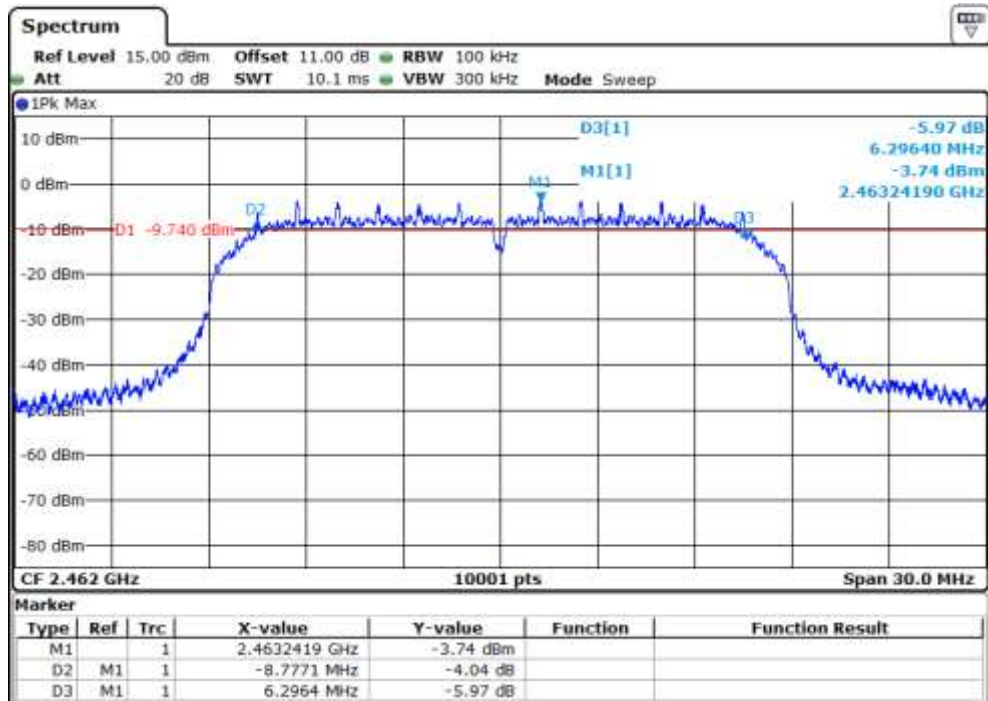
Channel 1 (F = 2412 MHz) – Mode 802.11n – bandwidth 20 MHz



Channel 6 (F = 2437 MHz) – Mode 802.11n – bandwidth 20 MHz



Channel 11 (F = 2462 MHz) – Mode 802.11n – bandwidth 20 MHz



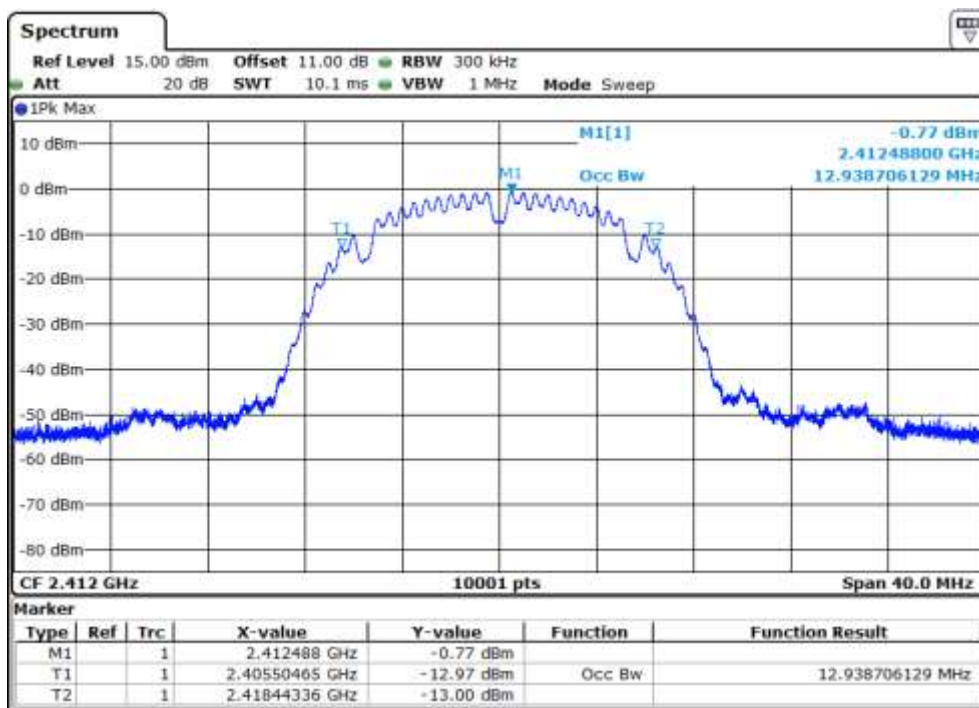
Limit:

Shall be at least 500 kHz

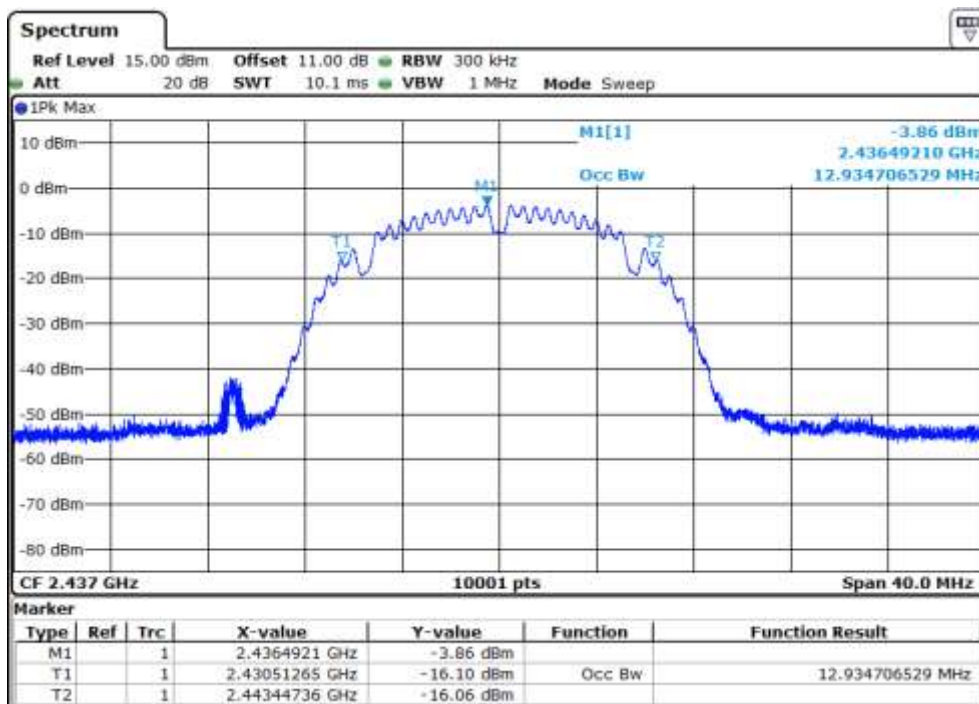
Results:

Sample N° 1: Measure of 99% bandwidth

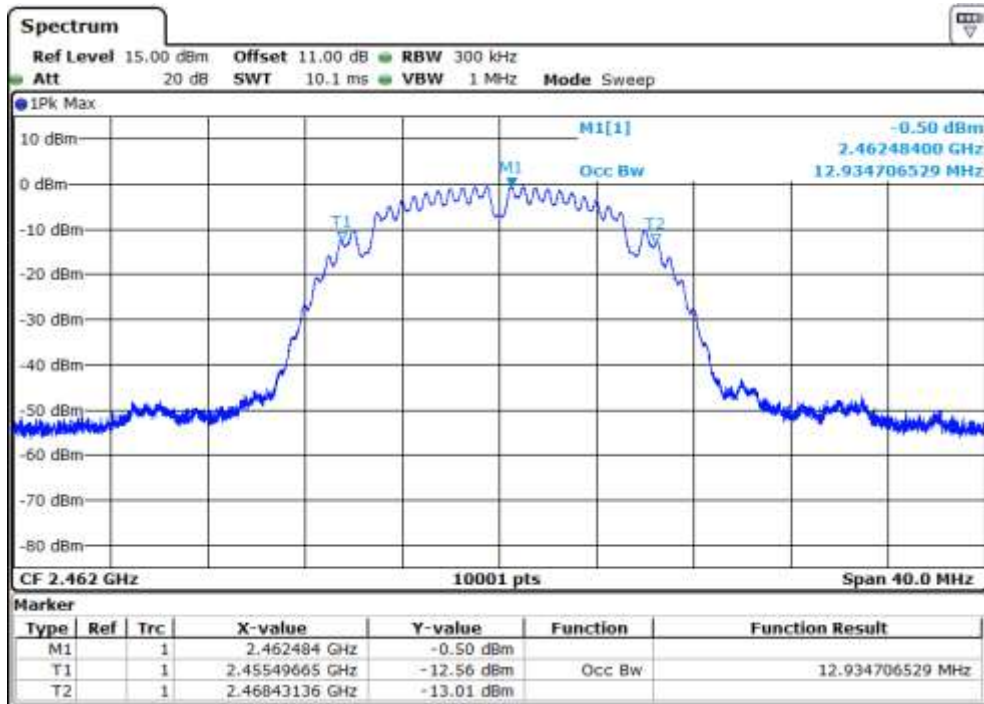
Channel 1 (F = 2412 MHz) – Mode 802.11b – bandwidth 20 MHz



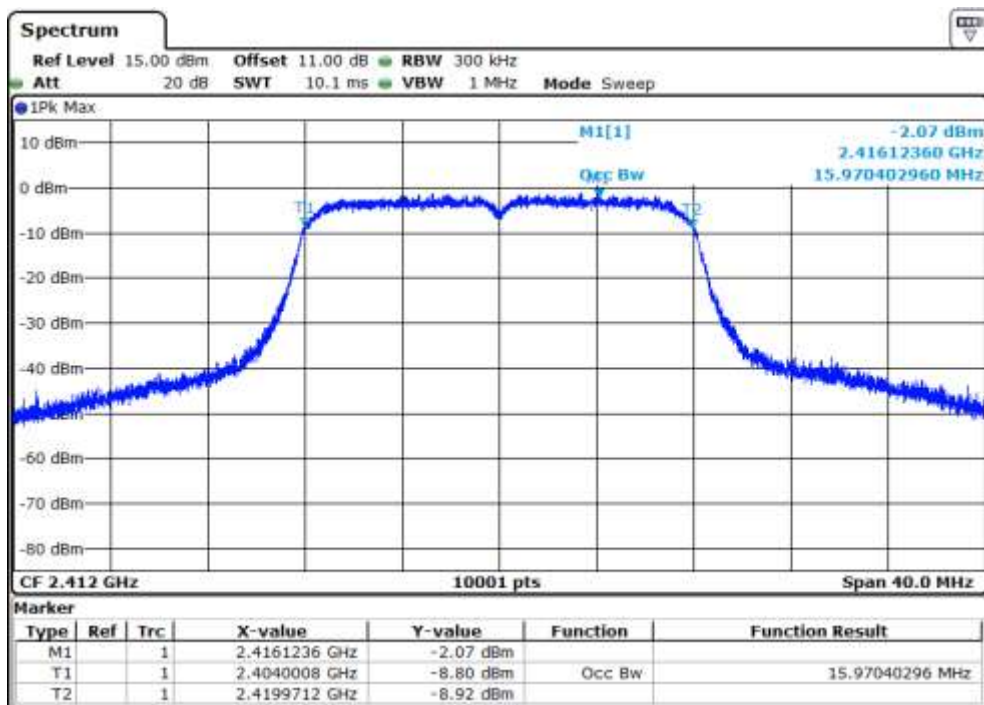
Channel 6 (F = 2437 MHz) – Mode 802.11b – bandwidth 20 MHz



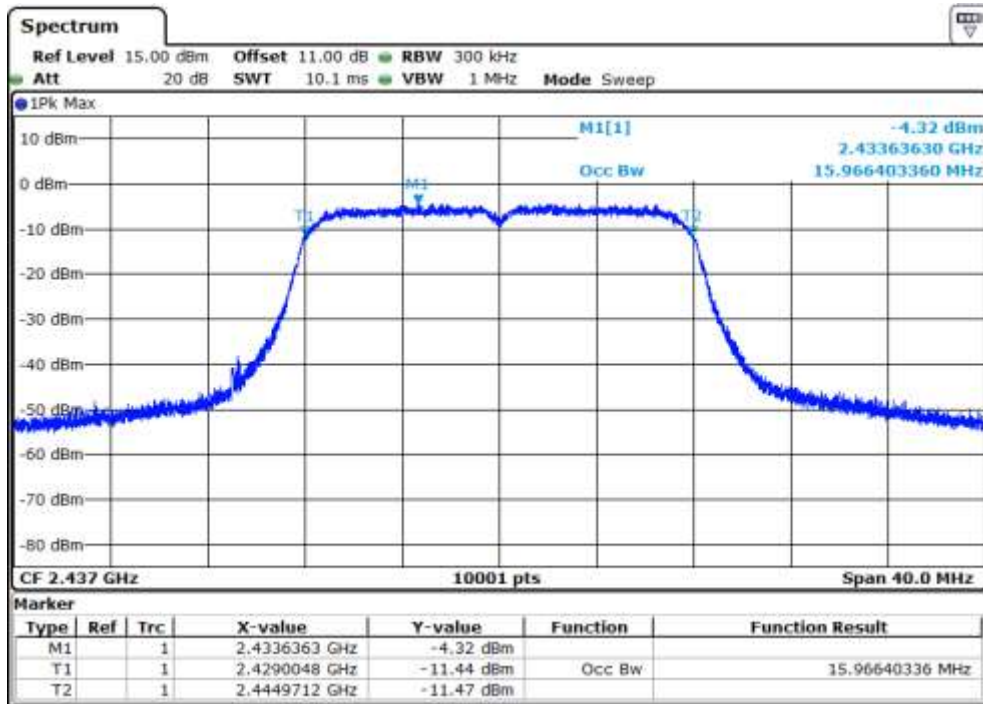
Channel 11 (F = 2462 MHz) – Mode 802.11b – bandwidth 20 MHz



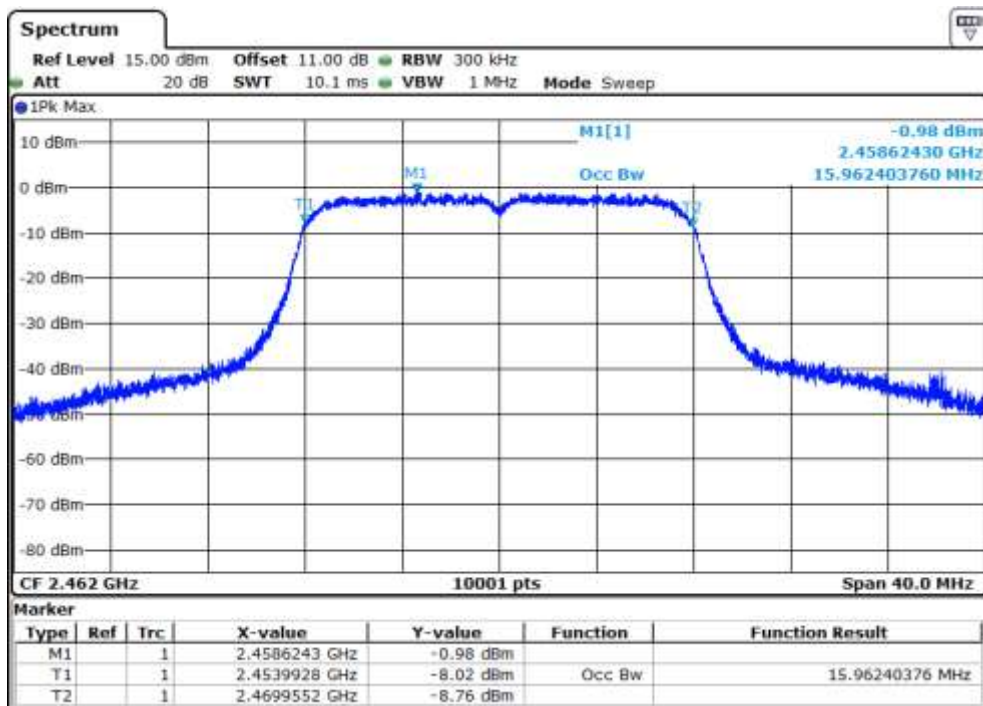
Channel 1 (F = 2412 MHz) – Mode 802.11g – bandwidth 20 MHz



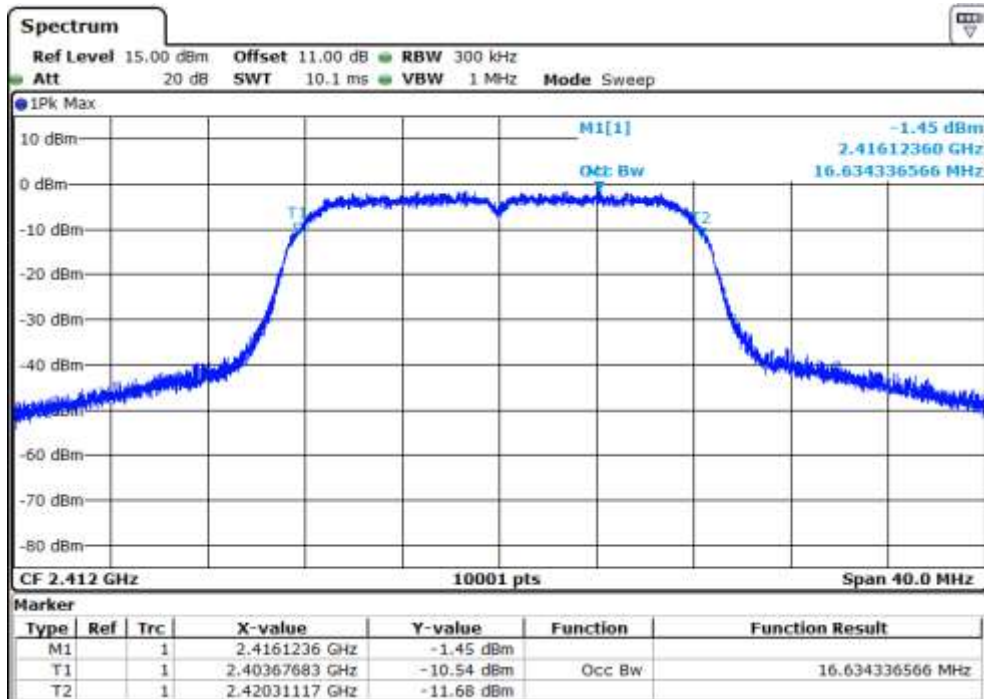
Channel 6 (F = 2437 MHz) – Mode 802.11g – bandwidth 20 MHz



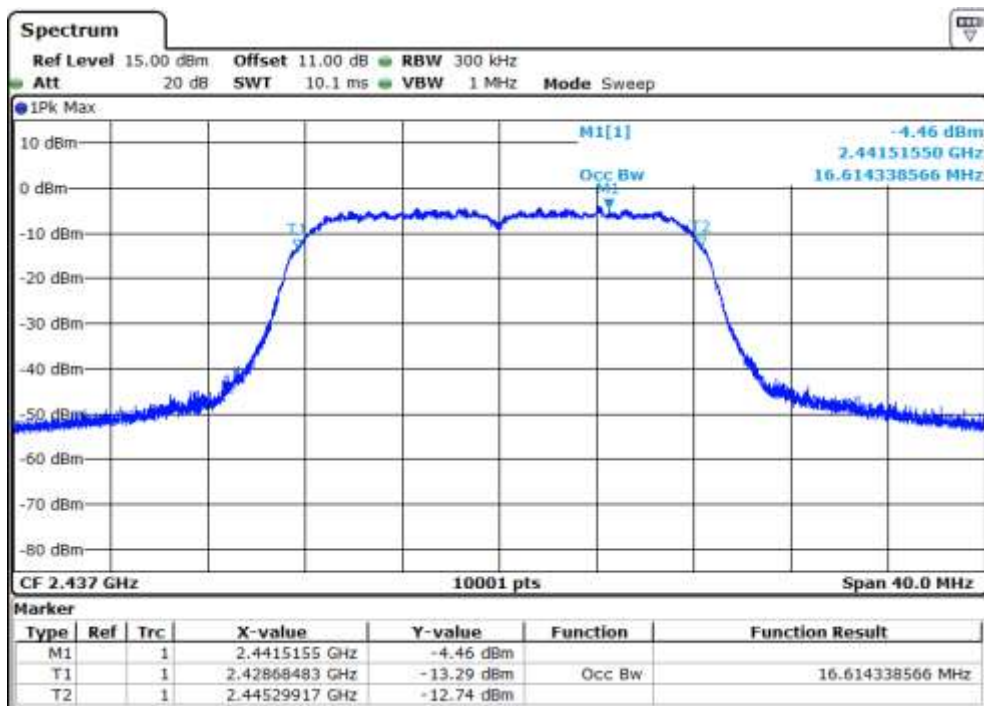
Channel 11 (F = 2462 MHz) – Mode 802.11g – bandwidth 20 MHz



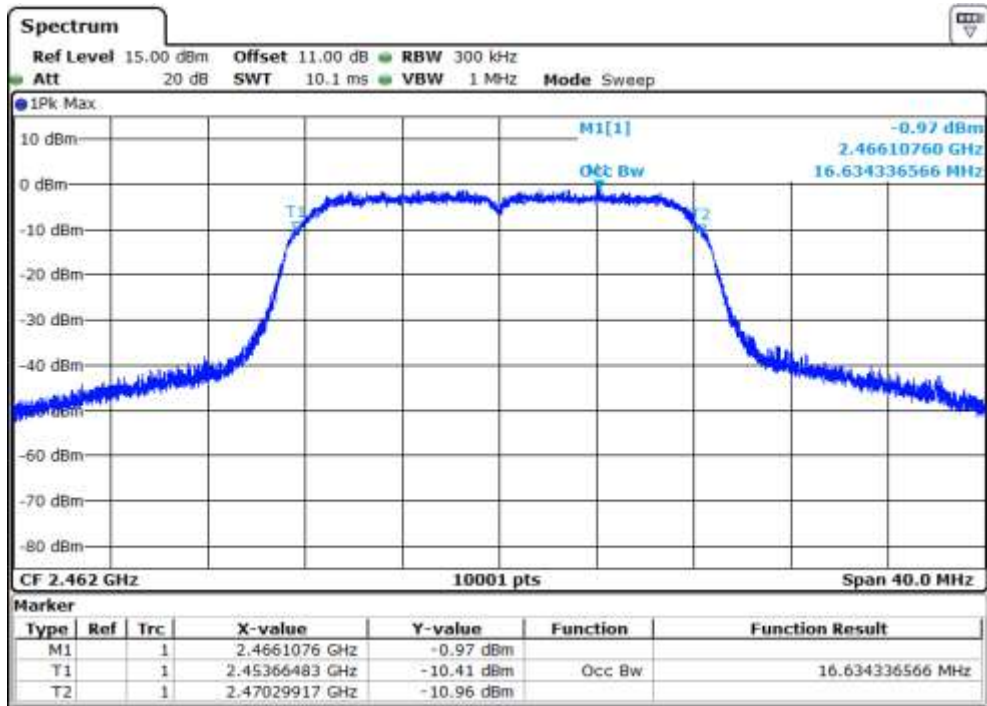
Channel 1 (F = 2412 MHz) – Mode 802.11n – bandwidth 20 MHz



Channel 6 (F = 2437 MHz) – Mode 802.11n – bandwidth 20 MHz



Channel 11 (F = 2462 MHz) – Mode 802.11n – bandwidth 20 MHz



Measure realized for reporting only

Test conclusion:

RESPECTED STANDARD

9. BAND EDGE**Temperature (°C) :** 27**Humidity (%HR):** 38**Date :** July 16, 2024**Technician :** T. LEDRESSEUR**Standard:** FCC Part 15
RSS-247**Test procedure:**

Method of paragraph 11.13.2 of ANSI C63.10

Method of paragraph 11.13.3 of ANSI C63.10

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.

We used for power source the internal fully charged battery

Results:

Lower Band Edge: From 2398 MHz to 2400 MHz

Upper Band Edge: From 2483.5 MHz to 2485.5 MHz

Sample N° 1 Mode 802.11b – bandwidth 20 MHz – Front

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Calculated Max Out-of-Band Emission Level (dBμV/m) (1)	Limit (dBμV/m)	Margin (dB)
2412	99.63	100	Peak	2398.03	47.29	69.63	22.34
2462	100.91	1000	Peak	2485.22	50.99	74	23.01
2462	100.91	1000	Average	2485.22	39.96	54	14.04

(1) Marker-Delta method

Sample N° 1 Mode 802.11g – bandwidth 20 MHz – Front

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Calculated Max Out-of-Band Emission Level (dBμV/m) (1)	Limit (dBμV/m)	Margin (dB)
2412	96.22	100	Peak	2399.81	54.9	66.22	11.32
2462	98.21	1000	Peak	2483.54	59.79	74	14.21
2462	98.21	1000	Average	2483.54	43.83	54	10.17

(1) Marker-Delta method

Sample N° 1 Mode 802.11n – bandwidth 20 MHz – Front

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Calculated Max Out-of-Band Emission Level (dBμV/m) (1)	Limit (dBμV/m)	Margin (dB)
2412	96.95	100	Peak	2399.8	55.2	66.95	11.75
2462	97.9	1000	Peak	2483.582	61.37	74	12.63
2462	97.9	1000	Average	2483.582	44.82	54	9.18

(1) Marker-Delta method

Test conclusion:

RESPECTED STANDARD

10. CONDUCTED OUTPUT POWER

Temperature (°C) : 27

Humidity (%HR): 38

Date : July 16, 2024

Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247

Test procedure:

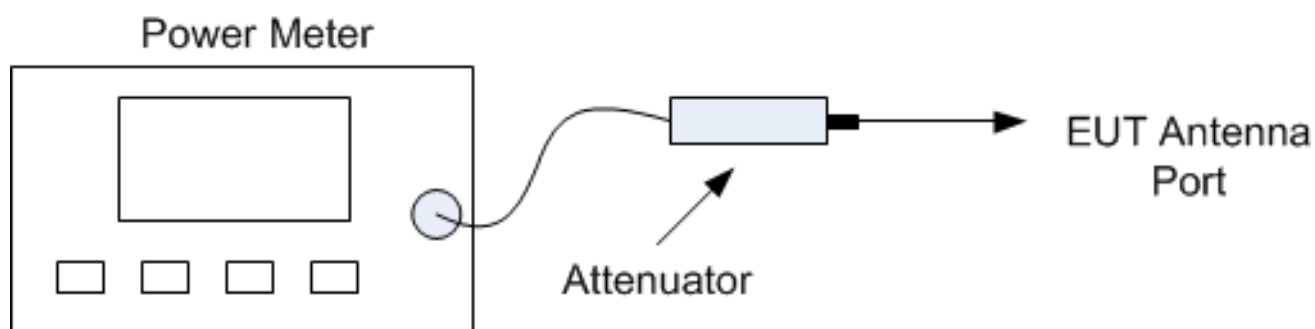
For FCC Part 15: paragraph 15.247 (b)

For RSS-247: paragraph 5.4

AVGPM-G method (using a gated RF average-reading power meter) of paragraph 11.9.2.3.2 of ANSI C63.10

Test set up:

Conducted test



The measure is realized in conducted mode with a calibrated gated RF average reading power meter.

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.

We used for power source the internal fully charged battery of the equipment:

Results:

Channel 1 (F = 2412 MHz) – Mode 802.11b – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	8.94	0.008	1	12.74	0.019	4

Declared maximum antenna gain: 3.8 dBi

Channel 6 (F = 2437 MHz) – Mode 802.11b – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	8.82	0.008	1	12.62	0.018	4

Declared maximum antenna gain: 3.8 dBi

Channel 11 (F = 2462 MHz) – Mode 802.11b – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	10.75	0.012	1	14.55	0.029	4

Declared maximum antenna gain: 3.8 dBi

Channel 1 (F = 2412 MHz) – Mode 802.11g – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	8.14	0.007	1	11.94	0.016	4

(1) Declared maximum antenna gain: 3.8 dBi

Channel 6 (F = 2437 MHz) – Mode 802.11g – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	8.22	0.007	1	12.02	0.016	4

(1) Declared maximum antenna gain: 3.8 dBi

Channel 11 (F = 2462 MHz) – Mode 802.11g – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	9.99	0.010	1	13.79	0.024	4

(1) Declared maximum antenna gain: 3.8 dBi

Channel 1 (F = 2412 MHz) – Mode 802.11n – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	8.04	0.006	1	11.84	0.015	4

(2) Declared maximum antenna gain: 3.8 dBi

Channel 6 (F = 2437 MHz) – Mode 802.11n – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	8.06	0.006	1	11.86	0.015	4

(1) Declared maximum antenna gain: 3.8 dBi

Channel 11 (F = 2462 MHz) – Mode 802.11n – bandwidth 20 MHz

	Maximum conducted output power (1)		Limit (W)	Maximum EIRP		Limit (W)
	(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	9.94	0.010	1	13.74	0.024	4

(1) Declared maximum antenna gain: 3.8 dBi

Test conclusion:

RESPECTED STANDARD

11. RADIATED SPURIOUS EMISSIONS**Temperature (°C) :** 27 to 29**Humidity (%HR):** 38 to 42**Date :** July 16, 2024 and July 17, 2024**Technician :** T. LEDRESSEUR**Standard:** FCC Part 15
RSS-247**Test procedure:**For FCC Part 15: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)
For RSS-247: paragraph 5.5Emissions 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:** (Refer Appendix 2)

First an exploratory radiated measurement was performed. During this phase the product is oriented in two orthogonal planes.

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

Below 1 GHz, the EUT is placed on a rotating table, 0.8m from a ground plane.
Above 1 GHz, 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.

See test setup in appendix 2

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency**Detection mode:** Quasi-peak (F < 1 GHz) Peak / Average (F > 1 GHz)**Bandwidth:** 200Hz (9 kHz < F < 150kHz)
9 kHz (150 kHz < F < 30MHz)
120 kHz (30 MHz < F < 1 GHz)
100 kHz / 1 MHz (F > 1 GHz)**Distance of antenna:** 3 meters (in anechoic room)**Antenna height:** 1 to 4 meters**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.

We used for power source the internal fully charged battery of the equipment.

Results:

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11b – bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2319.55 (1)	P	1000	V	47.32 (3)	74	26.68
4824 (1)	P	1000	V	63.3	74	10.7
4824 (1)	Av	1000	V	53.95	54	0.05
7236	P	100	H	49.95	69.63	19.68
19296 (1)	P	1000	H	40.1 (2) (3)	74	33.9
21708	P	100	H	41.02 (2)	69.63	28.61

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

(3) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11b – bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2320.33 (1)	P	1000	V	47.49 (3)	74	26.51
4874 (1)	P	1000	V	62.15	74	11.85
4874 (1)	Av	1000	V	52.8	54	1.2
7311 (1)	P	1000	H	45.45 (2) (3)	74	28.55
19496 (1)	P	1000	H	40.12 (2) (3)	74	33.88
21933	p	100	H	41.25 (2)	68.35	27.1

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

(3) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11b bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2319.72 (1)	P	1000	V	47.01 (3)	74	26.99
4924 (1)	P	1000	V	59.6	74	14.4
4924 (1)	Av	1000	V	50.25	54	3.75
7386 (1)	P	1000	H	46.23 (2) (3)	74	27.77
19696 (1)	P	1000	H	40.93 (3)	74	33.07
22158 (1)	P	1000	H	47.2 (3)	74	26.8

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

(3) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11g – bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
2320.2 (1)	P	1000	V	47.15 (3)	74	26.85
2389.8 (1)	P	1000	V	53.01	74	20.99
2389.8 (1)	Av	1000	V	40.2	54	13.8
4824 (1)	P	1000	V	63.4	74	10.6
4824 (1)	Av	1000	V	53.5	54	0.5
7236	P	100	H	50.8	66.22	15.42
19296 (1)	P	1000	H	40.14 (2) (3)	74	33.86
21708	P	100	H	41.32 (2)	66.22	24.9

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

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

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11g – bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
2320.1 (1)	P	1000	V	47.85 (3)	74	26.15
4874 (1)	P	1000	V	62.5	74	11.5
4874 (1)	Av	1000	V	52.6	54	1.4
7311 (1)	P	1000	H	45.12 (2) (3)	74	28.88
19496 (1)	P	1000	H	39.86 (2) (3)	74	34.14
21933	p	100	H	41.88 (2)	64.94	23.06

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

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

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11g bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2320.2 (1)	P	1000	V	48.04 (3)	74	25.96
4924 (1)	P	1000	V	60.5	74	13.5
4924 (1)	Av	1000	V	50.6	54	3.4
7386 (1)	P	1000	H	46.5 (2) (3)	74	27.5
19696 (1)	P	1000	H	40.23 (2) (3)	74	33.77
22158 (1)	P	1000	H	43.2 (3)	74	30.8

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

(3) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11n – bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2319.9 (1)	P	1000	V	44.77 (3)	74	29.23
2389.8 (1)	P	1000	V	55.32	74	18.68
2389.8 (1)	Av	1000	V	40.39	54	13.61
4824 (1)	P	1000	H	64.00	74	10
4824 (1)	P	1000	H	52.10	54	1.9
7236	P	100	H	48.2	66.95	18.75
19296 (1)	P	1000	H	40.21 (2) (3)	74	33.79
21708	P	100	H	41.35 (2)	66.95	25.6

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

(3) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11n – bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2319.9 (1)	P	1000	V	46.81 (3)	74	27.19
4874 (1)	P	1000	V	60.00	74	14
4874 (1)	Av	1000	V	48.10	54	5.9
7311 (1)	P	1000	H	45.85 (2) (3)	74	28.15
19496 (1)	P	1000	H	39.86 (2) (3)	74	34.14
21933	P	100	H	41.52 (2)	65.11	23.59

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

(3) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11n bandwidth 20 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2319.87 (1)	P	1000	V	48.15 (3)	74	25.85
4924 (1)	P	1000	V	59.6	74	14.4
4924 (1)	Av	1000	V	47.70	54	6.3
7386 (1)	P	1000	H	45.98 (2) (3)	74	28.02
19696 (1)	P	1000	H	39.88 (2) (3)	74	34.12
22158 (1)	P	1000	H	41.28 (3)	74	32.72

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

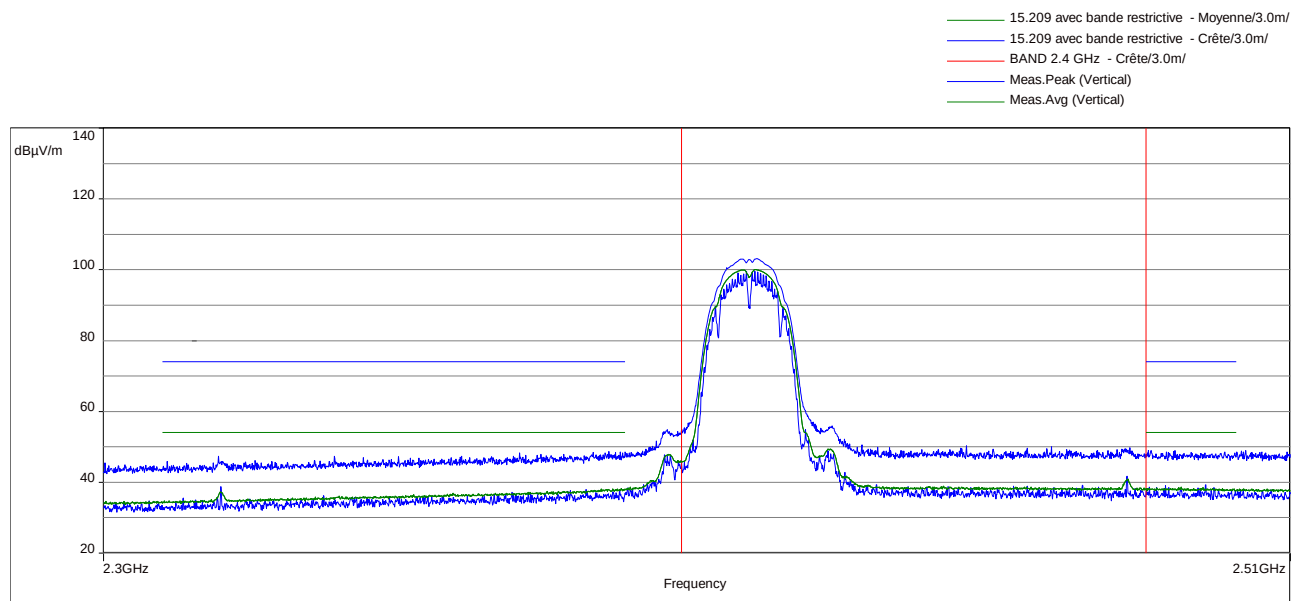
(3) The peak level is lower than the average limit (54 dB μ V/m)

Band edge worst-case measurement on worst critical positions

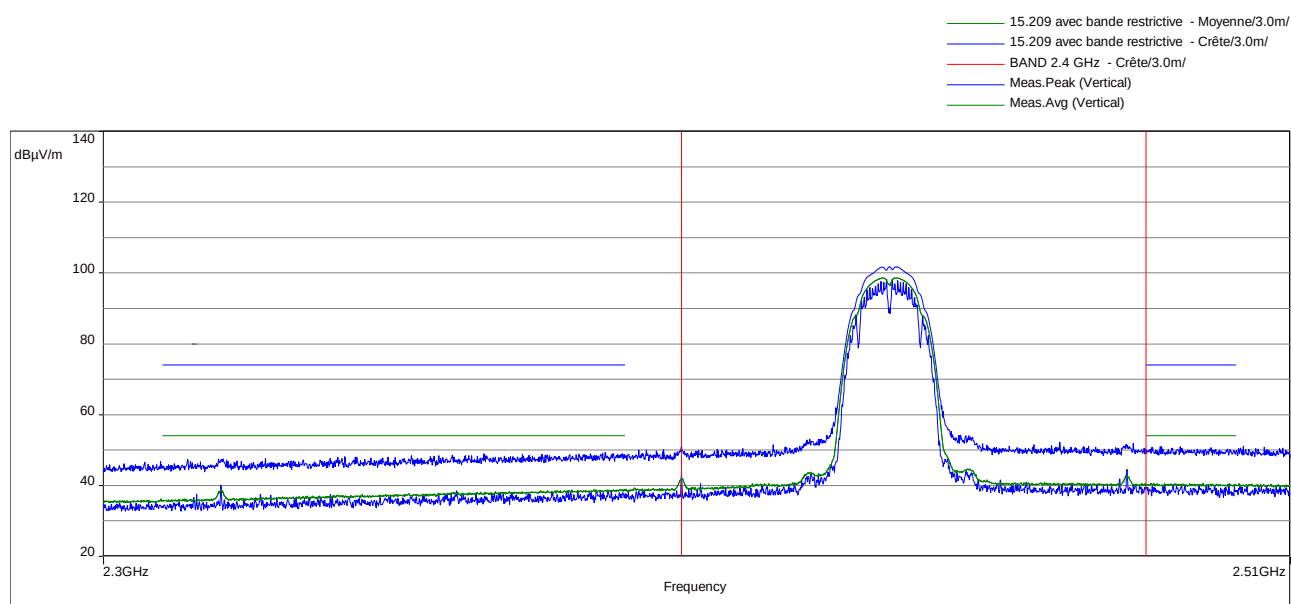
LEGEND:

- Blue curve represent measure with a peak detector obtained with 1 MHz and 100 kHz RBW
- Green curve represent measure with an average detector.
- Blue line is the peak limit.
- Green line is the average limit.
- Vertical red lines are the limits of the band. (2400 to 2483.5MHz)

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11b – bandwidth 20 MHz

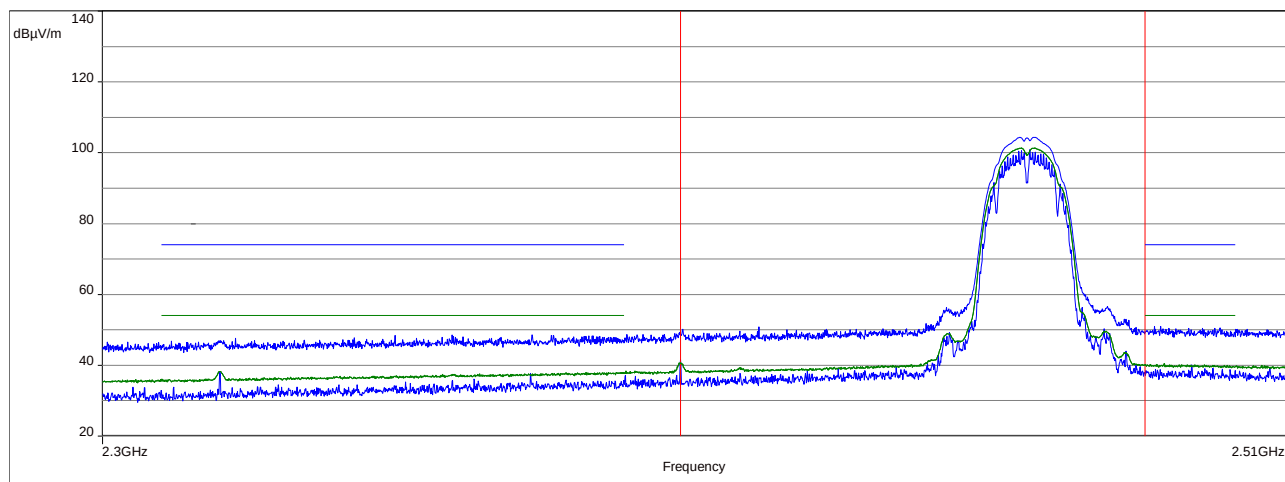


Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11b – bandwidth 20 MHz

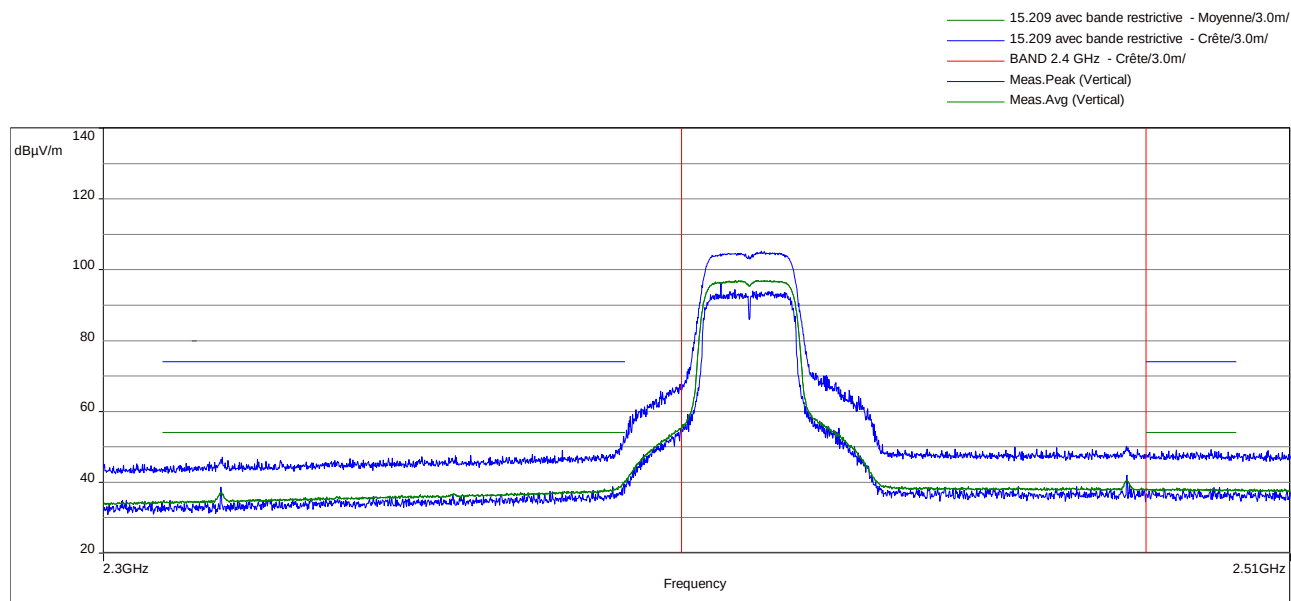


Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11.b bandwidth 20 MHz

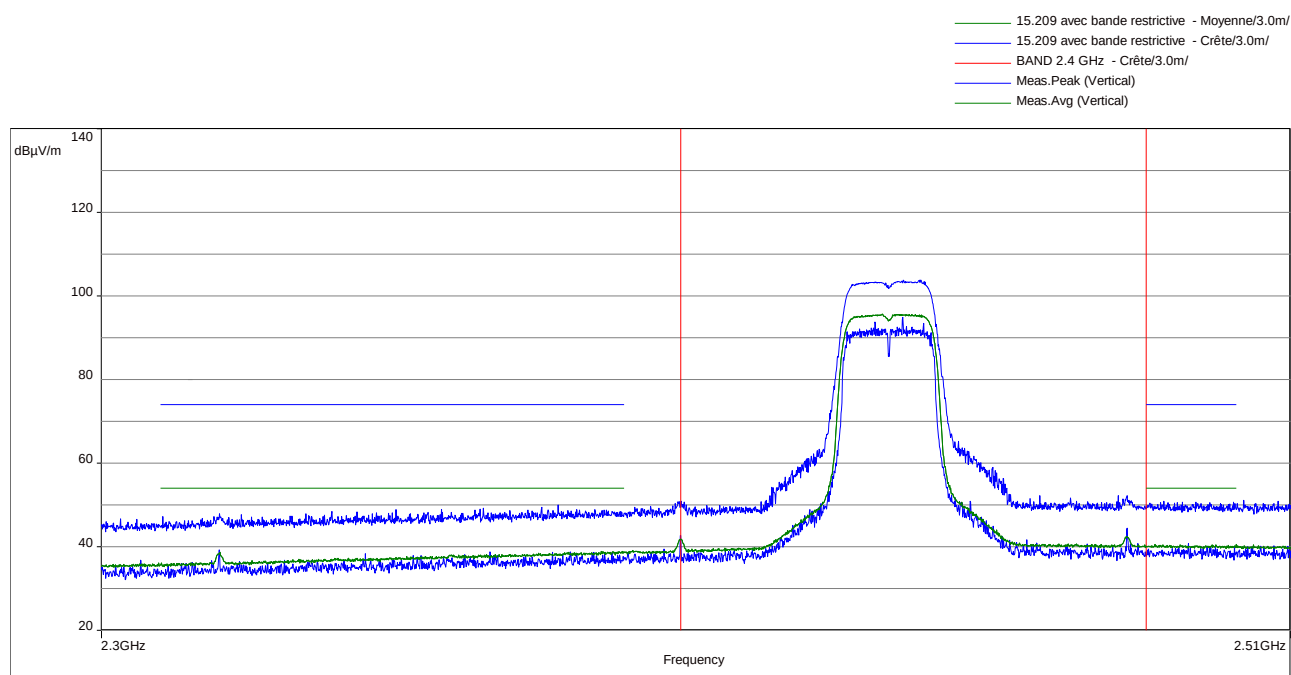
15.209 avec bande restrictive - Moyenne/3.0m/
 15.209 avec bande restrictive - Crête/3.0m/
 BAND 2.4 GHz - Crête/3.0m/
 Meas.Peak (Vertical)
 Meas.Avg (Vertical)



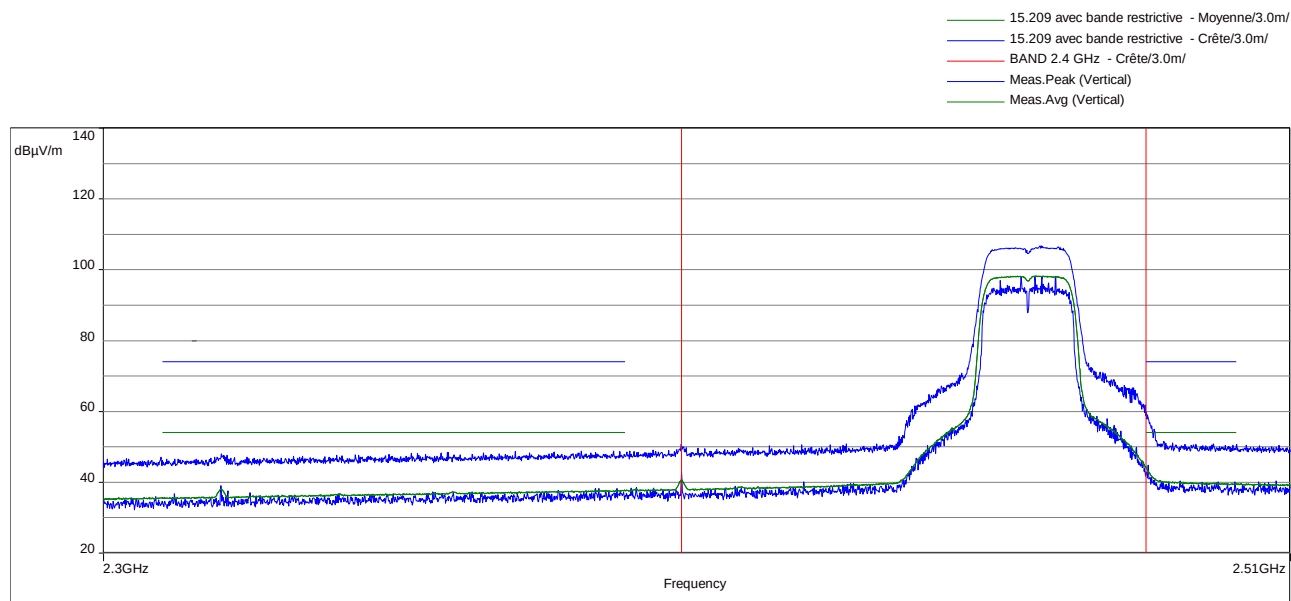
Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11g – bandwidth 20 MHz



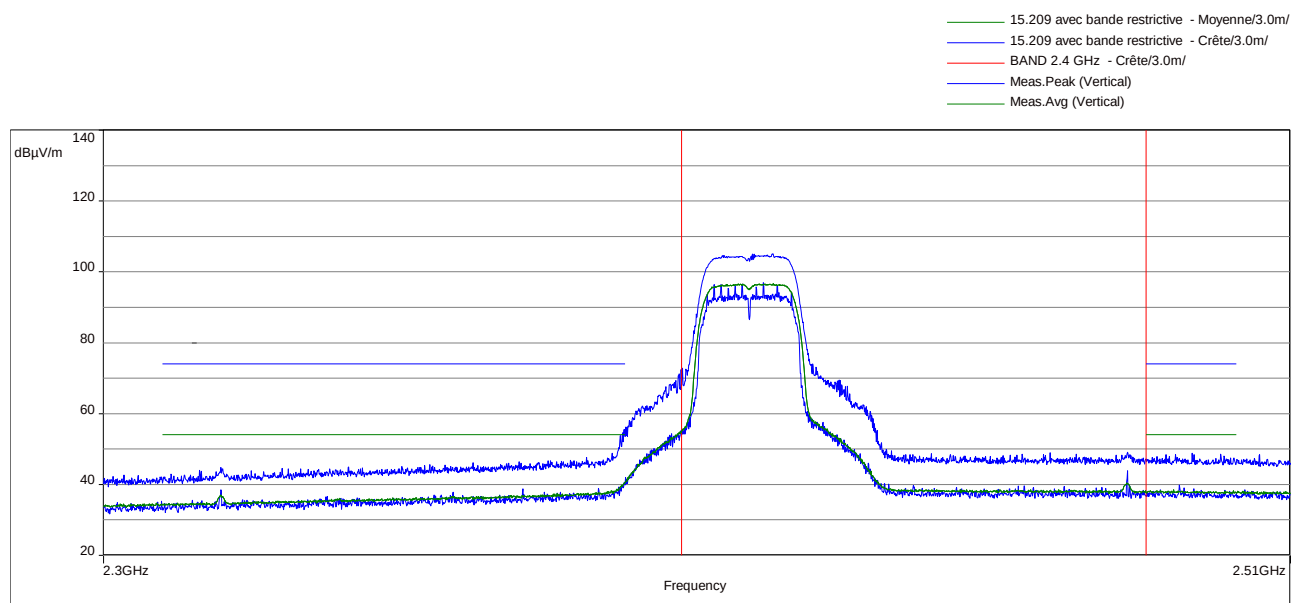
Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11g – bandwidth 20 MHz



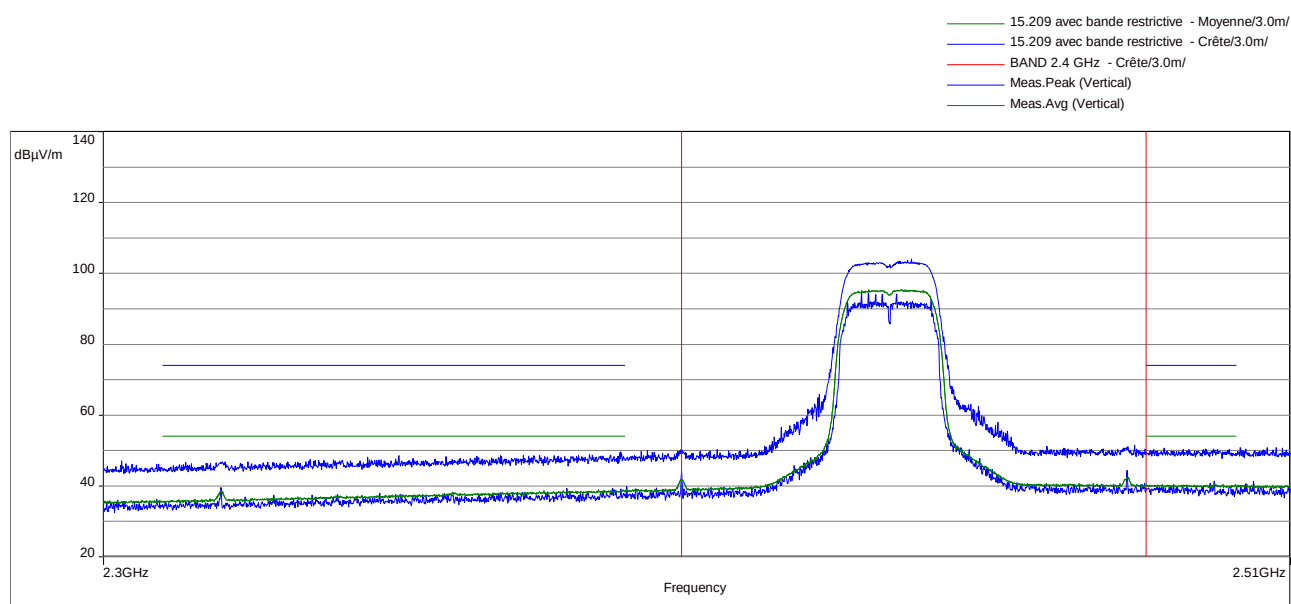
Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11g bandwidth 20 MHz



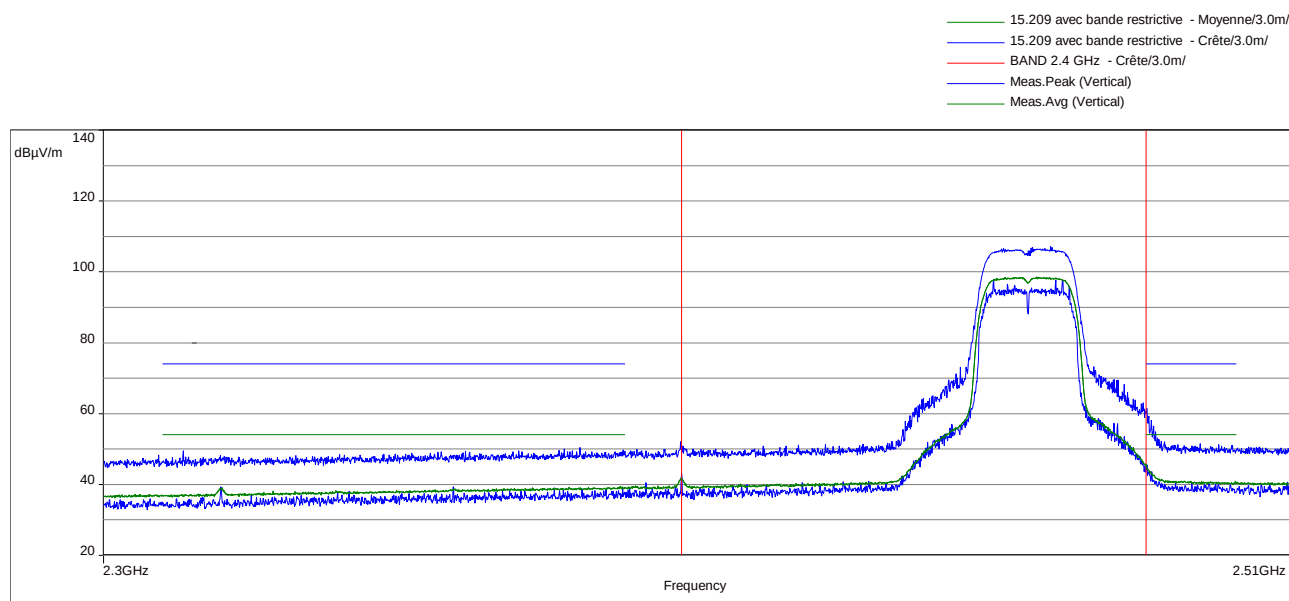
Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11n – bandwidth 20 MHz



Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11n – bandwidth 20 MHz



Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11n bandwidth 20 MHz



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.

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)).

In addition, radiated emissions which fall in the restricted band, as defined in Table 6 of RSS-Gen, must also comply with the radiated emission limits specified in Table 4 and Table 5 of RSS-Gen.

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Test conclusion:

RESPECTED STANDARD

12. CONDUCTED POWER SPECTRAL DENSITY

Temperature (°C) : 27

Humidity (%HR): 38

Date : July 16, 2024

Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247

Test procedure:

For FCC Part 15: paragraph 15.247 (e), paragraph 15.247 (f)

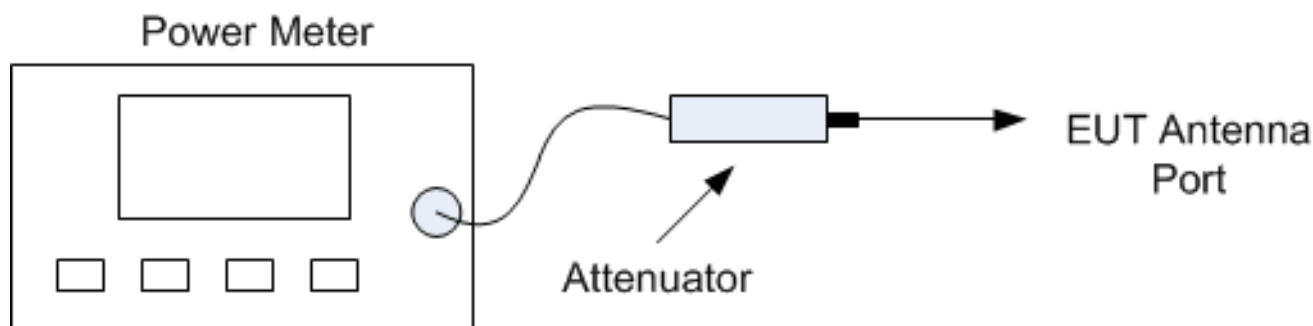
For RSS-247: paragraph 5.2

AVGPSD-1 of paragraph 10.3 of KDB 558074 for 802.11b mode

AVGPSD-2 of paragraph 10.5 of KDB 558074 for 802.11g and 802.11n modes

Test set up:

Conducted test



The measure is realized in conducted mode with an analyser.

Span	40 MHz
RBW	10 kHz
VBW	30 kHz
detector	RMS
Points	10000
Trace mode	Avg power
Number of traces	100

Then the peak marker function is used.

Then the measure is adjusted with the duty cycle correction factor ($10\log(1/x)$ with x is the duty cycle)

The measure is repeated on each output port of the EUT. Then the results were summed in linear power unit.

Equipment under test operating condition:

The equipment under test is blocked in discontinuous modulated transmission mode with constant duty cycle, at the highest output power level at which the transmitter is intended to operate in 802.11b, 802.11g and 802.11n modes.

Duty cycle measured:

802.11b, duty cycle > 98 %, no correction factor used

802.11g

Ton=2.08 ms

Toff=0.135 ms

X= 94%

Correction= $10 \log (1/X) = 0.27$

802.11n

Ton=1.88 ms

Toff= 0.12 ms

X= 94

Correction= $10 \log (1/X) = 0.27$

The correction factors are integrated on the different results.

We used for power source the internal fully charged battery of the equipment:

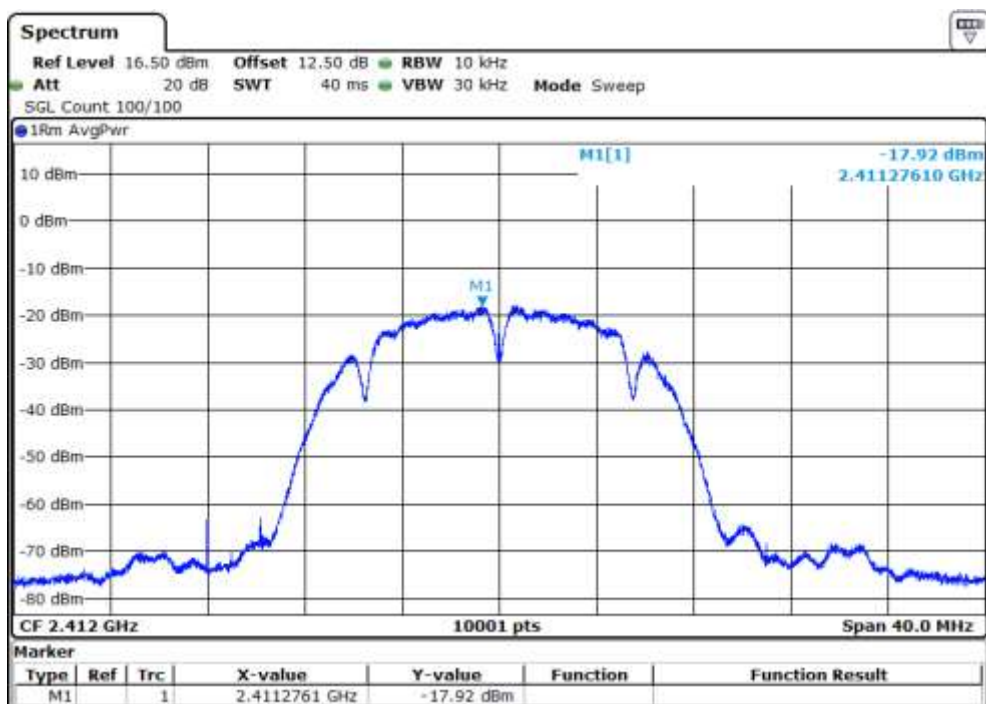
Results:

Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11b – bandwidth 20 MHz

	Maximum conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-17.92	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi

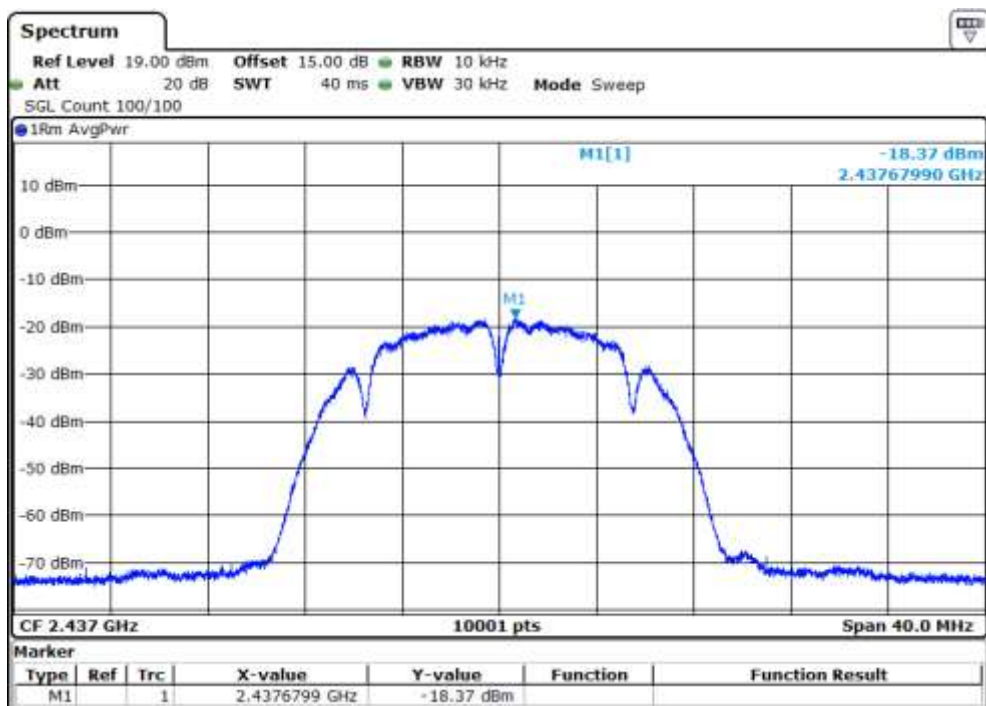


Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11b – bandwidth 20 MHz

	Maximum conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-18.37	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi

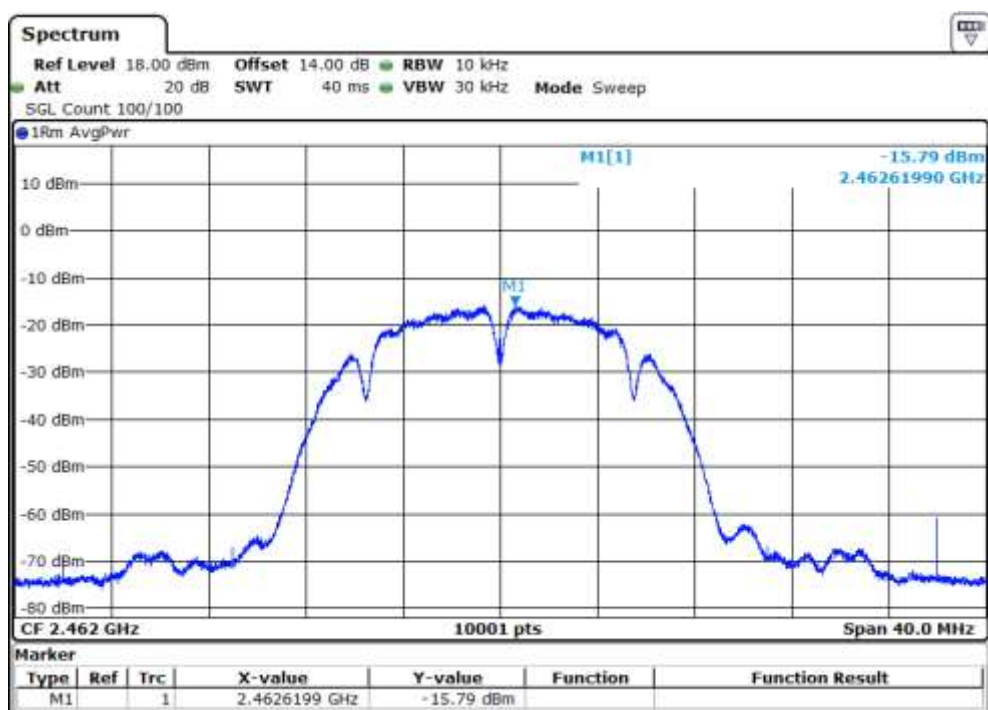


Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11b bandwidth 20 MHz

	Maximum conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-15.79	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi

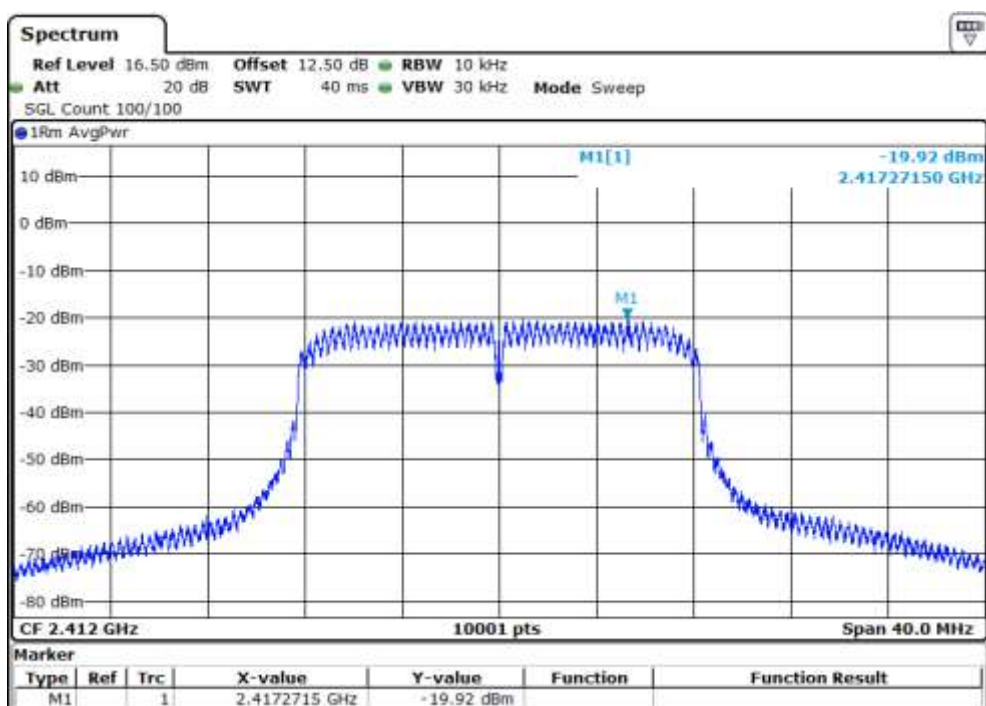


Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11g – bandwidth 20 MHz

	Maximum conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-19.92	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi

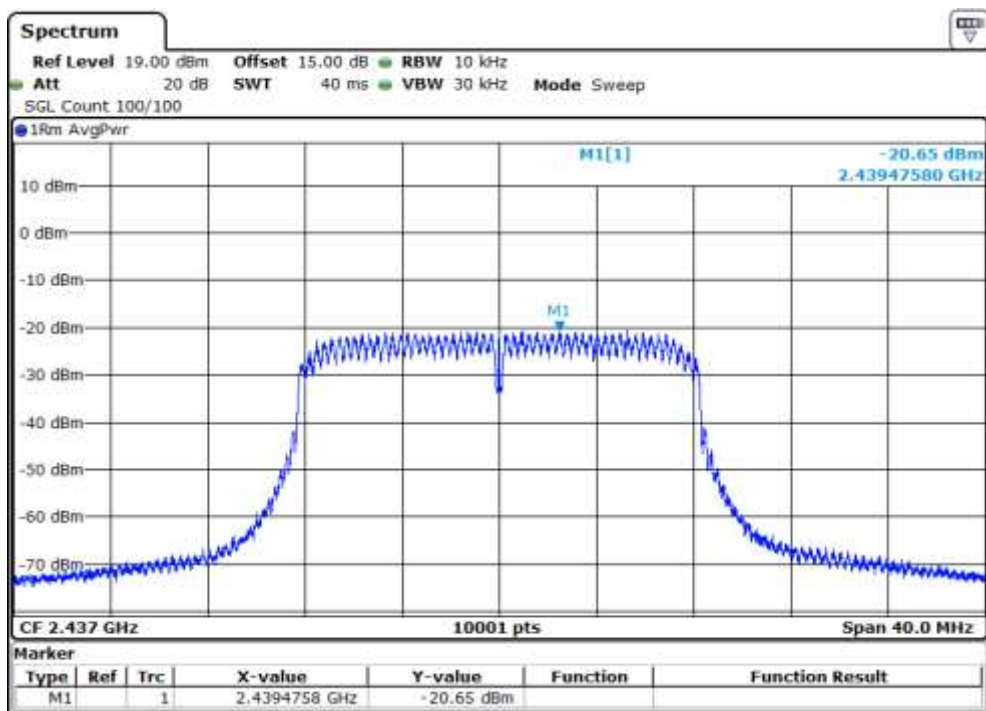


Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11g – bandwidth 20 MHz

	Maximum Peak conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-20.65	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi

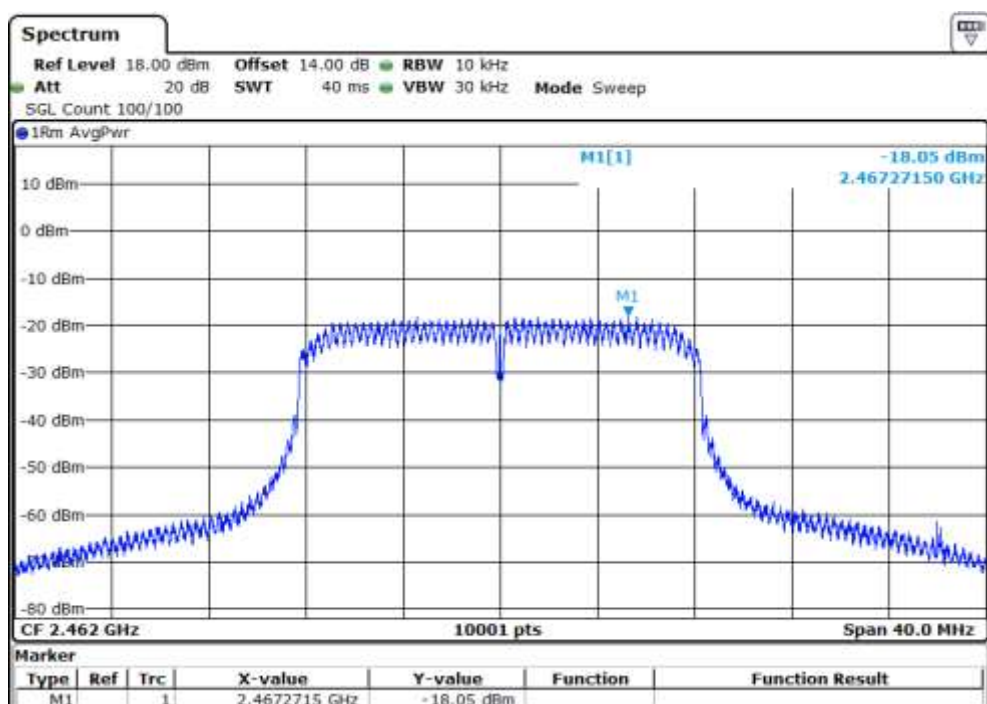


Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11g bandwidth 20 MHz

	Maximum conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-18.05	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi

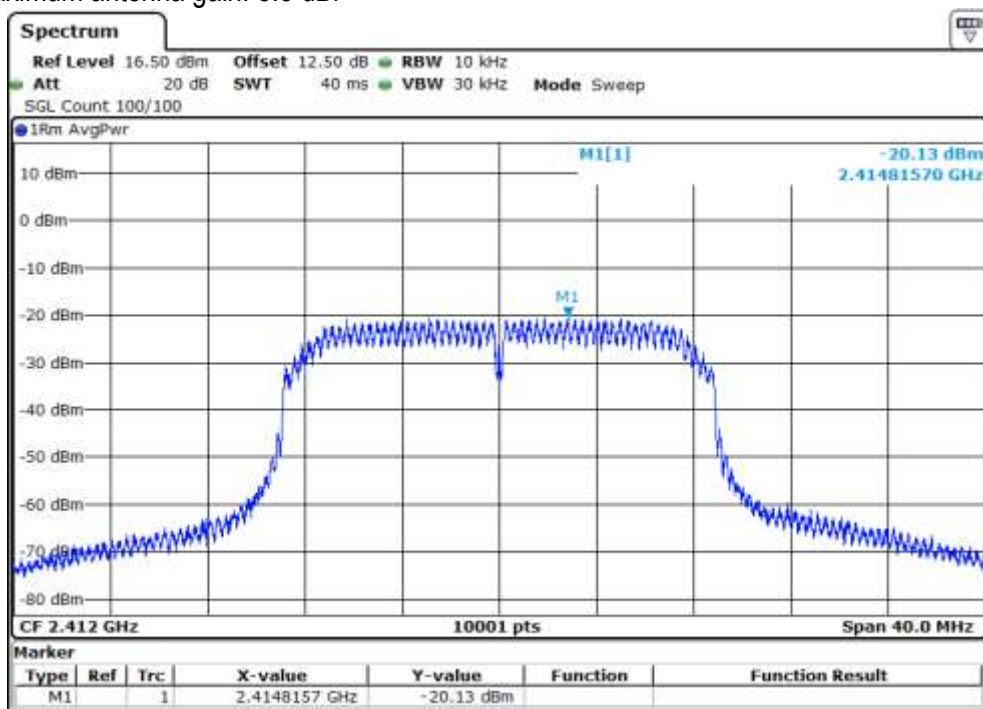


Sample N° 1 Channel 1 (F = 2412 MHz) – Mode 802.11n – bandwidth 20 MHz

	Maximum conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-20.13	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi

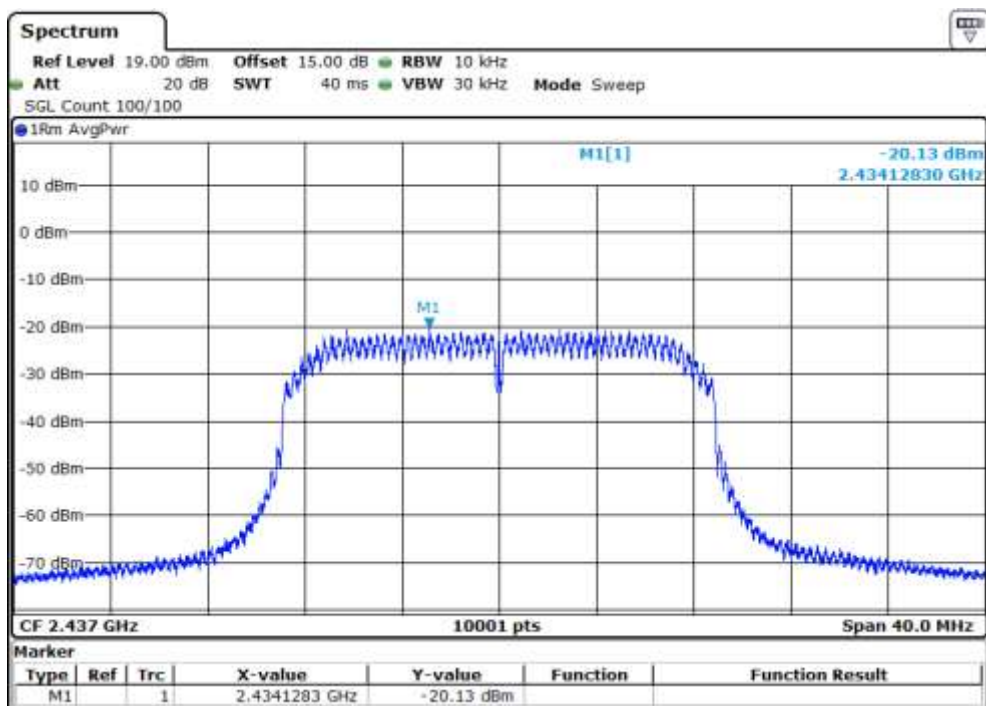


Sample N° 1 Channel 6 (F = 2437 MHz) – Mode 802.11n – bandwidth 20 MHz

	Maximum conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-20.13	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi

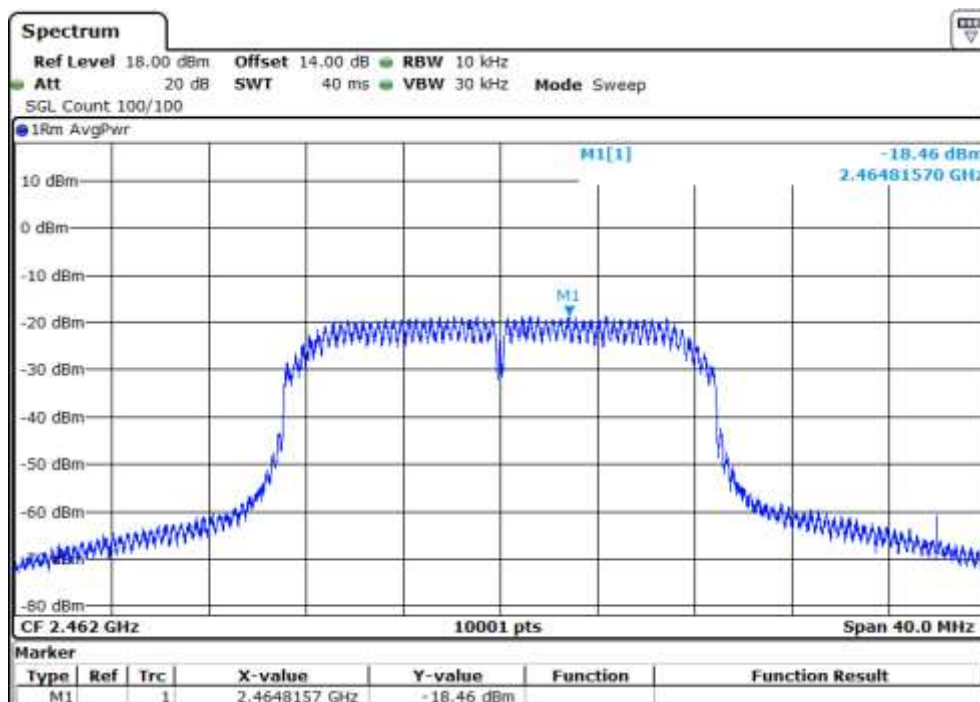


Sample N° 1 Channel 11 (F = 2462 MHz) – Mode 802.11n bandwidth 20 MHz

	Maximum conducted power density (dBm / 10 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-18.46	8

(1) duty cycle included

Declared maximum antenna gain: 3.8 dBi



Test conclusion:

RESPECTED STANDARD

□□□ End of report, (2) appendix(es) to be forwarded □□□

APPENDIX 1: Test equipment list

Occupied bandwidth

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Attenuator 10dB 18GHz 2W	Weinschel	12492
Multimeter 177	Fluke	19114
Meteo station 608-H1	Testo	15790

Band edge

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Anechoic Chamber	EMITECH	7651
Antenna BBHA 9120B	Schwarzbeck	6970
Low-noise amplifier 8449B	Agilent Technologies	10262
Cable N-3m	Huber + Suhner	15892
Cable SMA-3m	Huber + Suhner	15893
Cable SMA-3m	Huber + Suhner	15916
Cable SMA-4m	Huber + Suhner	15933
High pass filter HP12/1200-5AA	Filtek	7302
Multimeter 177	Fluke	19114
Meteo station WS-9232	La Crosse Technology	7564
Software	BAT-EMC V3.18.0.26	0000

Conducted output power

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Power sensor NRV-Z86	Rohde & Schwarz	11588
Attenuator 10dB 18GHz 2W	Weinschel	12492
Multimeter 177	Fluke	19114
Meteo station 608-H1	Testo	15790
Software	R&S Power Viewer Plus V13.1	///

Radiated spurious emissions

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Anechoic Chamber	EMITECH	7651
Biconical antenna HK116	Rohde & Schwarz	6118
Log periodic antenna 3146A	EMCO	5609
Low-noise amplifier INT-BA011000-25	RFPA	15775
Antenna BBHA 9120B	Schwarzbeck	6970
Low-noise amplifier 8449B	Agilent Technologies	10262
Cable k 1m	Huber + Suhner	14522
Antenna 3160-09	ETS lindgren	14690
Low-noise amplifier	Low-noise amplifier	14851
Cable K-15cm	JYE BAO	14887
Cable N-3m	Huber + Suhner	15892
Cable SMA-3m	Huber + Suhner	15893
Cable SMA-3m	Huber + Suhner	15916
Cable SMA-4m	Huber + Suhner	15933
High pass filter HPM15162	Microtronics	14037
Multimeter 177	Fluke	19114
Meteo station WS-9232	La Crosse Technology	7564
Software	BAT-EMC V3.18.0.26	0000

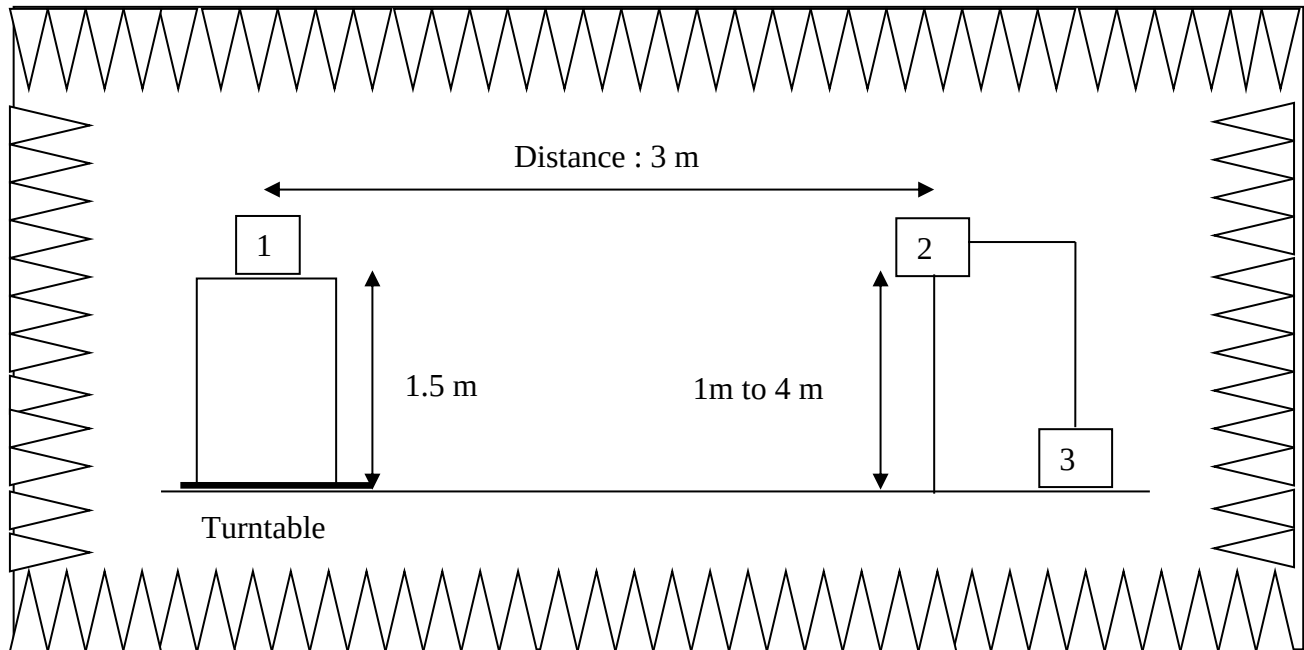
Conducted power spectral density

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Attenuator 10dB 18GHz 2W	Weinschel	12492
Multimeter 177	Fluke	19114
Meteo station 608-H1	Testo	15790

APPENDIX 2: Radiated Test Setup

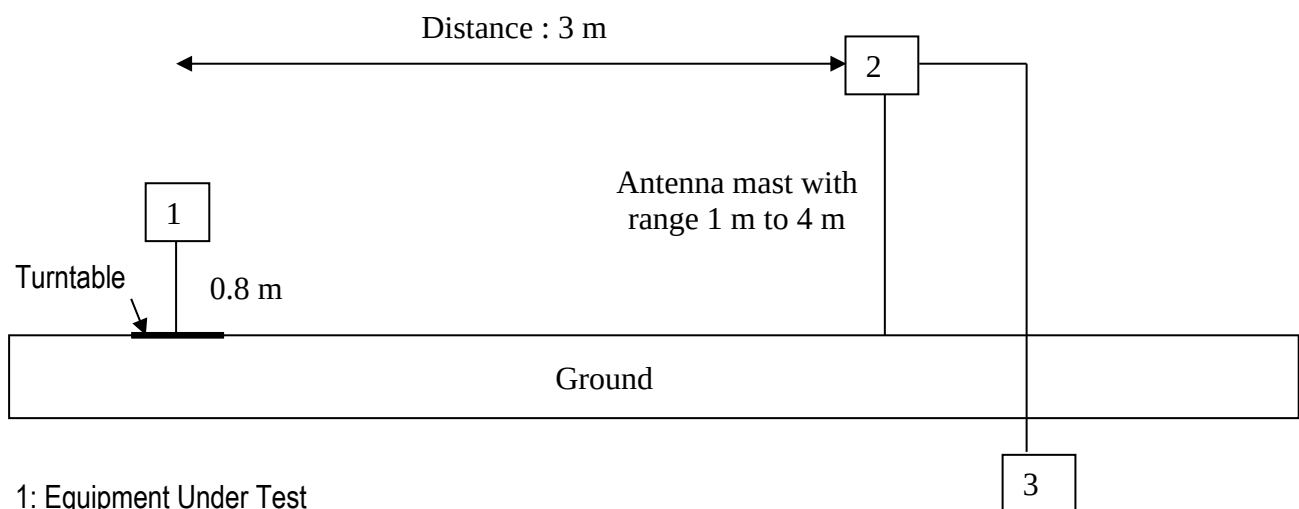
Anechoic chamber setup

Above 1 GHz



- 1: Equipment Under Test
- 2: Measurement antenna
- 3: Measurement equipment

Between 30 MHz and 1 GHz



- 1: Equipment Under Test
- 2: Measurement antenna
- 3: Measurement equipment