

RR051-14-103407-2-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
GROUND MODEM EBEE

FCC ID:
2AC2VGMEBEE

Company:
SENSEFLY

DISTRIBUTION: Mr GILLE

(Company: SENSEFLY)

Number of pages: 74 with 10 appendixes

Ed.	Date	Modified pages	Written by		Technical Verification and Quality Approval	
			Name	Visa	Name	Visa
0	24/08/2015	Creation	M. DUMESNIL	M. D.	O. ROY	

Duplication of this test report 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.



DESIGNATION OF PRODUCT: GROUND MODEM

Serial number (S/N): EB-02-687

Reference / model (P/N): EBEE

Software version: Not communicated

MANUFACTURER: SENSEFLY

COMPANY SUBMITTING THE PRODUCT:

Company: SENSEFLY

Address: Route de Genève 38
1033 Cheseaux-Lausanne
SWITZERLAND

Responsible: Mr GILLE

DATE(S) OF TEST: Between 04-AUG-2014 to 11-SEP-2014
18 and 19-MAR-2015
21-AUG-2015

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
EMITECH ANGERS open area test site in JUIGNE SUR LOIRE (49)
FRANCE
21 rue de la Fuye
49610 Juigne sur Loire
France
FCC 2.948 Listed Site Registration Number: 90469
FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

TESTED BY: M. DUMESNIL

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1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: **GROUND MODEM EBEE** in accordance with normative reference.

The equipment integrates radio module already certified but the module's OEM manual is not respected.

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Remote control of drone
Antenna type and gain:	external dipole antenna, 2.5 dBi with RPSMA connector
Operating frequency range:	from 2401.6 MHz to 2476.35 MHz
Number of channels:	76
Channel spacing:	minimum 275 kHz measured
Modulation:	type FHSS
Power source:	5Vdc by an USB connector

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 (2014) Radio Frequency Devices

ANSI C63.4 2009
Methods of measurement of Radio-Noise
Emissions from low-voltage Electrical and Electronic Equipment in the Range
of 9 kHz to 40 GHz.

ANSI C63.10 2009
Testing Unlicensed Wireless Devices.

Public Notice DA 00-705 Filing and Measurement Guideline for Frequency Hopping Spread
Spectrum Systems.

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart A –General

Paragraph 19: labelling requirements
Paragraph 21: information to user

Subpart B –Unintentional Radiators

Paragraph 105: information to the user
Paragraph 107: Conducted limits
Paragraph 109: Radiated emission limits
Paragraph 111: Antenna power conduction limits for receivers

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 verification	Next verification	Validity
0000	BAT-EMC V3.6.0.32	Software	/	/	/
1922	Microwave DB C020180F-4B1	Low-noise amplifier	20/08/2014	20/08/2015	20/10/2015
1939	IMC WR42	Antenna	20/04/2012	20/04/2016	20/06/2016
1940	IMC WR42	Antenna	20/04/2012	20/04/2016	20/06/2016
3036	ALC Microwave ALN02-0102	Low-noise amplifier	14/05/2014	14/05/2015	14/07/2015
4088	R&S FSP40	Spectrum Analyzer	22/08/2013	22/08/2015	22/10/2015
7299	Microtronics BR50702	Reject band filter	25/10/2013	25/10/2015	25/12/2015
8508	California instruments 1251RP	Power source	22/08/2014	22/08/2015	22/10/2015
8511	HP 8447D	Low noise preamplifier	20/08/2014	20/08/2015	20/10/2015
8526	Schwarzbeck VHBB 9124	Biconical antenna	12/06/2012	12/06/2016	12/08/2016
8528	Schwarzbeck VHA 9103	Biconical antenna	24/09/2013	24/09/2017	24/11/2017
8533	R&S HFH2-Z2	Loop antenna	11/02/2014	11/02/2016	11/04/2016
8535	EMCO 3115	Antenna	29/10/2012	29/10/2016	29/12/2016
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	12/06/2012	12/06/2016	12/08/2016
8635	R&S EZ-25	High-pass filter	05/08/2014	05/08/2016	05/10/2016
8677	IDM106N	Multimeter	24/04/2013	24/04/2015	24/06/2015
8707	R&S ESI7	Test receiver	11/12/2014	11/12/2016	11/02/2017
8719	Thurbly Thandar Instruments 1600	LISN	23/06/2014	23/06/2016	23/08/2016
8732	Emitech	OATS	23/08/2013	23/08/2016	23/10/2016
8749	La Crosse Technology WS-9232	Meteo station	03/09/2014	03/09/2016	03/11/2016
8750	La Crosse Technology WS-9232	Meteo station	03/09/2014	03/09/2016	03/11/2016
8783	EMCO 3147	Log periodic antenna	24/09/2013	24/09/2017	24/11/2017
8864	Champ libre Juigné. V3.4	Software	/	/	/
8893	Emitech	Outside room Hors cage	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9489	Absorber sheath current	Emitech	08/10/2014	08/10/2016	08/12/2016
10317	Fluke 177	Multimeter	12/06/2013	12/06/2015	12/08/2015

6. TESTS AND CONCLUSIONS

6.1 general (subpart A)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.19	LABELLING REQUIREMENTS	X				
FCC Part 15.21	INFORMATION TO USER	X				

NAp: Not Applicable

NAs: Not Asked

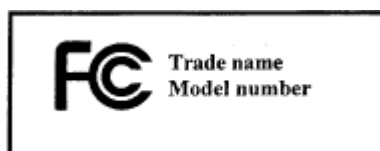
LABEL SHALL CONTAIN

The label shall be located in a conspicuous location on the device

The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase

§15.19: (can be placed in the user manual if the product is too small)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

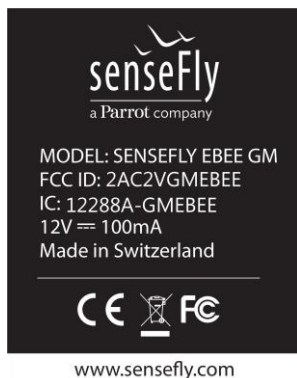


USER NOTICE SHALL CONTAIN

§15.21:

Any changes or modifications to this equipment not expressly approved by SENSEFLY may cause, harmful interference and void the FCC authorization to operate this equipment

Label:



Extract of the notice “eBee and eBee Ag Revision 13 / November 2014” (p3/60):

FCC and iC Compliance statement :



This device complies with part 15 of the FCC Rules and Industry Canada License-exempt RSS standard(s).

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

6.2 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.105	INFORMATION TO THE USER	X				
FCC Part 15.107	CONDUCTED LIMITS	X				Class B
FCC Part 15.109	RADIATED EMISSION LIMITS	X				Class B
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable

NAs: Not Asked

USER NOTICE SHALL CONTAIN

§ 15.105:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference's by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Extract of the notice “eBee and EBee Ag Revision 13 / November 2014” (p3/60):

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and uses in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna
2. Increase the separation between the equipment and the receiver
3. Connect the equipment into a an outlet on a circuit different from that to which the receiver is connected
4. Consult the dealer or an experienced radio/TV technician for help.

6.3 intentional radiator (subpart C)

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				Note 4
	(a) (2) Digital modulation techniques			X		
	(b) Maximum peak output power	X				Note 5
	(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				Note 6

NAp: Not Applicable

NAs: Not Asked

Note 1: Integral / dedicated antenna. Professionally installed equipment.

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 system hops to channel frequencies from a pseudo randomly ordered list of hopping frequencies. Each frequency is used equally on the average by the transmitter, and separated by a minimum of 25 kHz / 20 dB bandwidth of the hopping channel (see appendix 7).

The frequency hopping system uses 76 channels (see appendix 9).

The timing by channel is 2340 μ s (see appendix 8).

During 76 channels \times 0.4 s =30.4 s, any channel is used 9 times (see appendix 8), then $9 \times 2340 \mu$ s = 21.06 ms, thus the average time of occupancy on any channel is less than 400 ms within a period of 0.4 seconds multiplied by the number of hopping channels employed, in normal operating mode.

Note 5: We used the radiated method in open field.

RF EXPOSURE:

Note 6: In accordance with KDB 447498 D01 General RF Exposure Guidance v05r02

$PSD = EIRP / (4 * \pi * R^2) = 0.07033 / (4 * \pi * (20 \text{ cm})^2) = 13.99 \times 10^{-6} \text{ mW/cm}^2$ (limit= 1 mW/cm²).

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

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

7. MEASUREMENT OF THE CONDUCTED DISTURBANCES

Standard: FCC Part 15

Test procedure: Paragraph 15.107

Limits: Class B

Software used: BAT-EMC V3.6.0.32

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.

See photos in appendix 2

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak

Bandwidth: 10 kHz

Equipment under test operating condition:

The equipment is blocked in discovery mode.

Results:

Ambient temperature (°C): 23.4
Relative humidity (%): 34

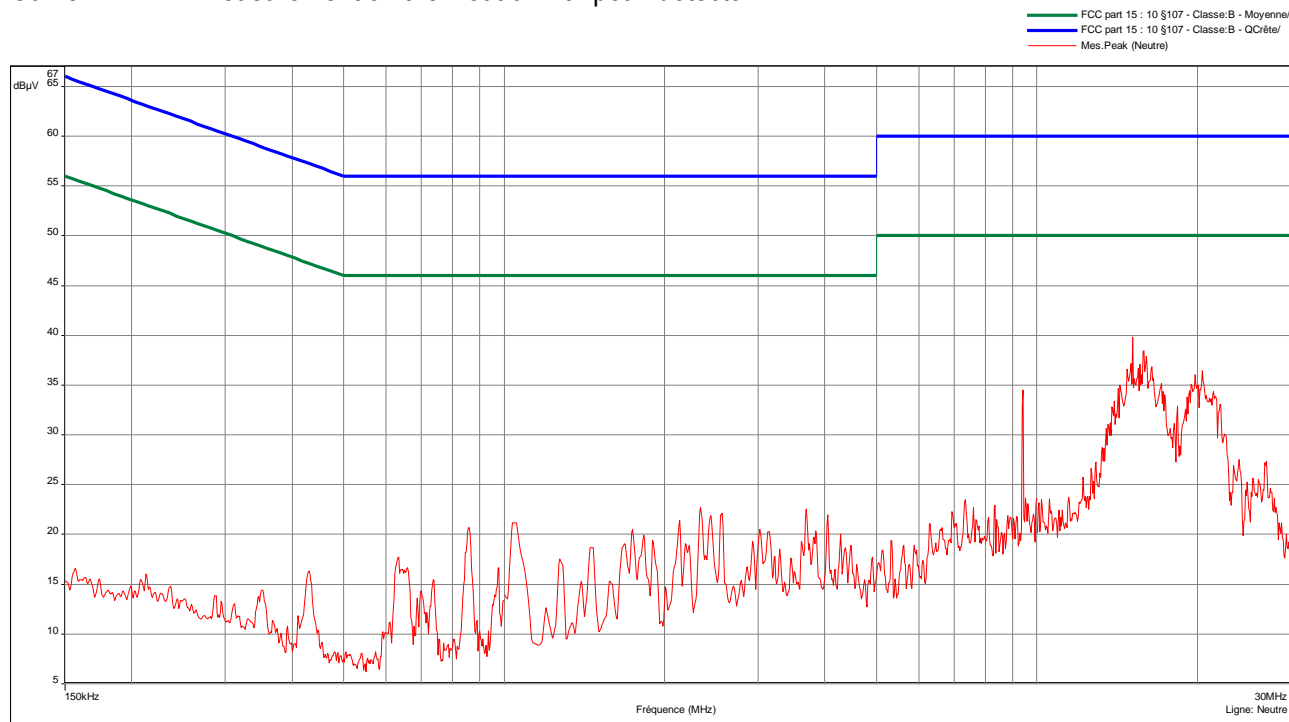
Power source: 5Vdc by an USB port of a computer powered in 120Vac / 60Hz

Sample N° 1:

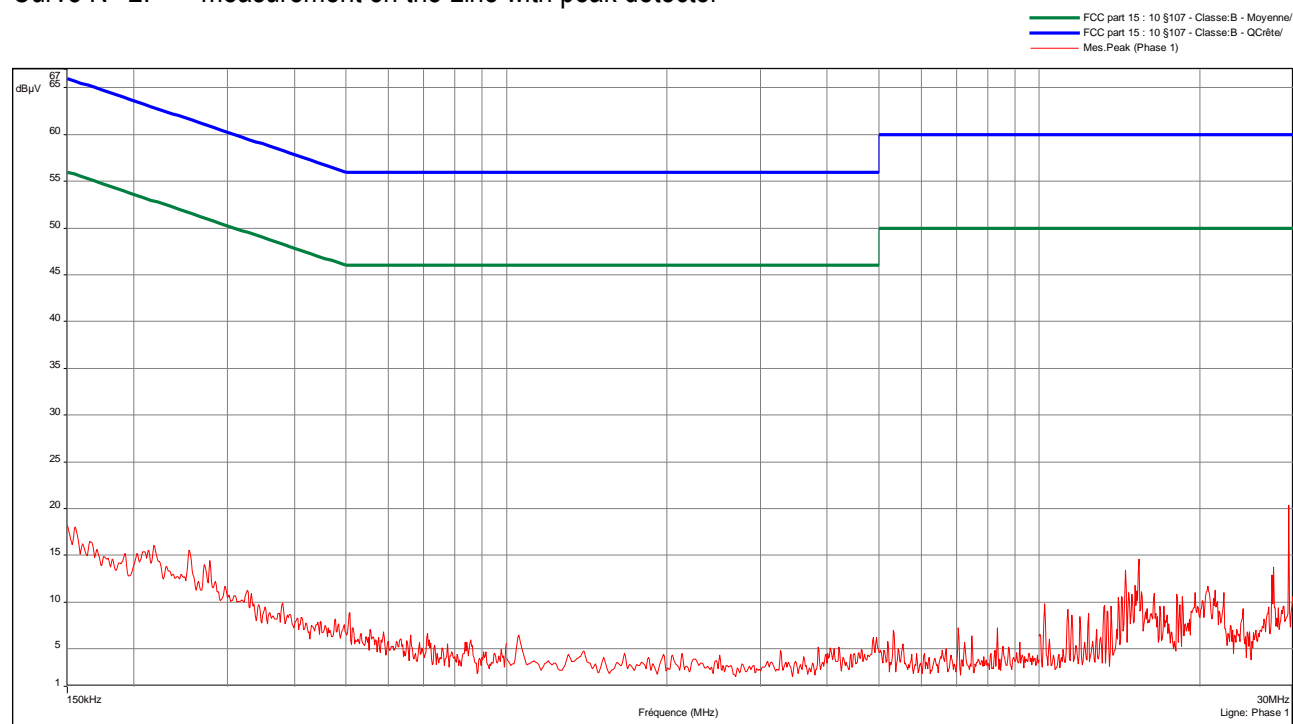
Measurement on the mains power supply:

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



Test conclusion:

RESPECTED STANDARD

8. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class B

Test set up:

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, 1.5m from a ground plane.

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

See photos in appendix 2.

Frequency range: From 30 MHz to 12.4GHz (5th harmonic of the highest frequency used)

Detection mode: Quasi-peak (F < 1 GHz) Average (F > 1 GHz)

Bandwidth: 120 kHz (F < 1 GHz) 1 MHz (F > 1 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 is blocked in discovery mode.

Results:

Ambient temperature (°C): 16.5
Relative humidity (%): 40

Power source: 5Vdc by a USB port of a computer powered in 120Vac / 60Hz

Sample N° 1

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi- Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
200.02	QP	144	360	V	42.33	43.5	1.16
214.68	QP	349	207	H	40.34	46	5.66
500.02	QP	326	336	V	39.77	46	6.23
700.02	QP	400	103	H	36.00	46	10.00
900.02	QP	221	158	V	36.77	46	9.23

Applicable limits: for $30 \text{ MHz} \leq F \leq 88 \text{ MHz}$: 40 dBμV/m at 3 meters
for $88 \text{ MHz} < F \leq 216 \text{ MHz}$: 43.5 dBμV/m at 3 meters
for $216 \text{ MHz} < F \leq 960 \text{ MHz}$: 46 dBμV/m at 3 meters
Above 960 MHz : 54 dBμV/m at 3 meters

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

Test conclusion:

RESPECTED STANDARD

9. MEASUREMENT OF THE CONDUCTED DISTURBANCES

Standard: FCC Part 15

Test procedure: Paragraph 15.207

Software used: BAT-EMC V3.6.0.32

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.

See photos in appendix 2

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak

Bandwidth: 10 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.

Results:

Ambient temperature (°C): 23.4
Relative humidity (%): 34

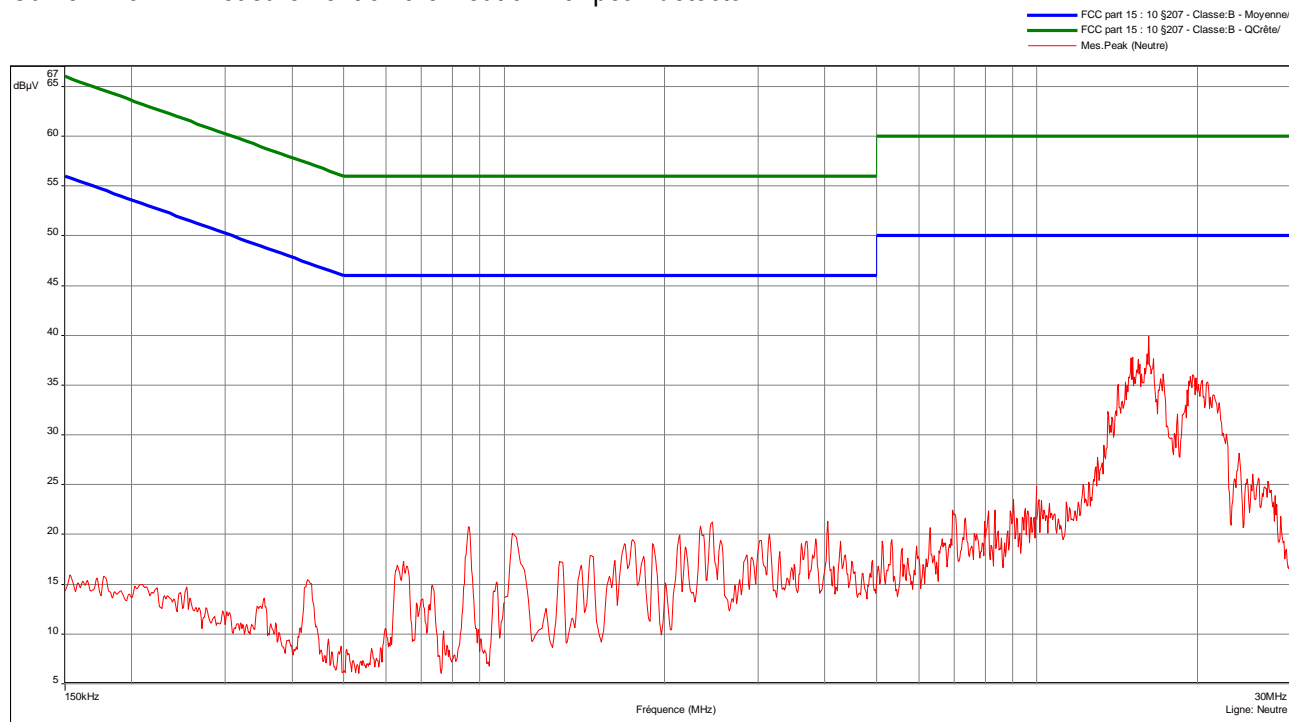
Power source: 5Vdc by an USB port of a computer powered in 120Vac / 60Hz

Sample N° 1:

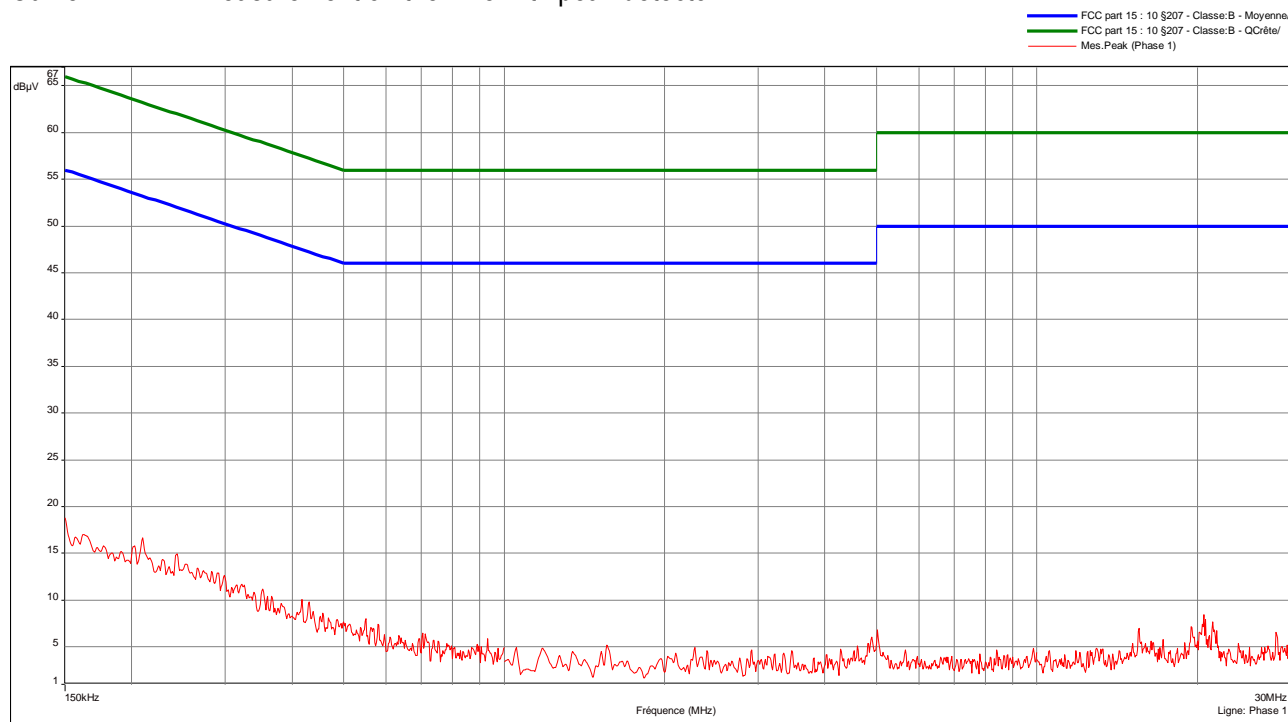
Measurement on the mains power supply:

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



Test conclusion:

RESPECTED STANDARD

10. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

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 transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 24
Relative humidity (%): 55

Power source: 5Vdc by a USB port of a computer powered in 120Vac / 60Hz

Lower Band Edge: from 2398 MHz to 2400 MHz
Upper Band Edge: from 2483.5 MHz to 2485.5 MHz

Sample N° 1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2401.5395	116.2	Peak	2399.728	-43.94	72.26	96.2	23.94
2476.334875**	112.9	Peak	2483.621375	-61.21	51.69***	74	22.31
2476.334875**	112.9	Average	2484.627188	-81.06	31.84	54	22.16

* Marker-Delta method ** restricted bands of operation in 15.205

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

20 dB bandwidth curves are given in appendix 5; band-edge curves are given in appendix 6.

Test conclusion:

RESPECTED STANDARD

11. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Test set up:

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, 1.5m from a ground plane.

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

See photos in appendix 2.

The measurement of the electro-magnetic field is realized, with a resolution bandwidth adjusted at 1 MHz and video bandwidth at 3 MHz.

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)

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.

Results:

Ambient temperature (°C): 25.2
Relative humidity (%): 52

Power source: 5Vdc by an USB port of a computer powered in 120Vac / 60Hz

Sample N° 1 Low channel (F=2401.6 MHz)

	Electro-magnetic field (dBμV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage:	116.2	0.070	1

Polarization of test antenna: vertical (height: 150 cm)

Position of equipment: see photos in appendix 2 (azimuth: 352 degrees)

Sample N° 1 Central channel (F=2440.8 MHz)

	Electro-magnetic field (dBμV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage:	114.9	0.052	1

Polarization of test antenna: vertical (height: 150 cm)

Position of equipment: see photos in appendix 2 (azimuth: 12 degrees)

Sample N° 1 High channel (F=2476.35 MHz)

	Electro-magnetic field (dBμV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage:	112.9	0.032	1

Polarization of test antenna: vertical (height: 150 cm)

Position of equipment: see photos in appendix 2 (azimuth: 21 degrees)

* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1.78$

Antenna gain: 2.5 dBi

Test conclusion:

RESPECTED STANDARD

12. INTENTIONAL RADIATOR

Standard: FCC Part 15

Test procedure: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)

Test set up:

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, 1.5m from a ground plane.

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

See photos in appendix 2.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (2476.4 MHz) .

Detection mode: Quasi-peak ($F < 1 \text{ GHz}$)

Peak / Average ($F > 1 \text{ GHz}$)

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.

Results:

Ambient temperature (°C): 26.8
Relative humidity (%): 57

Power source: 5Vdc by an USB port of a computer powered in 120Vac / 60Hz

Sample N° 1 Low channel (F=2401.6 MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
200.02	QP	144	360	120	V	42.33	96.2	53.87
214.68	QP	349	207	120	H	40.34	96.2	55.86
500.02	QP	326	336	120	V	39.77	96.2	56.43
700.02	QP	400	103	120	H	36.00	96.2	60.20
900.02	QP	221	158	120	V	36.77	96.2	59.43

Sample N° 1 Central channel (F=2440.8 MHz)

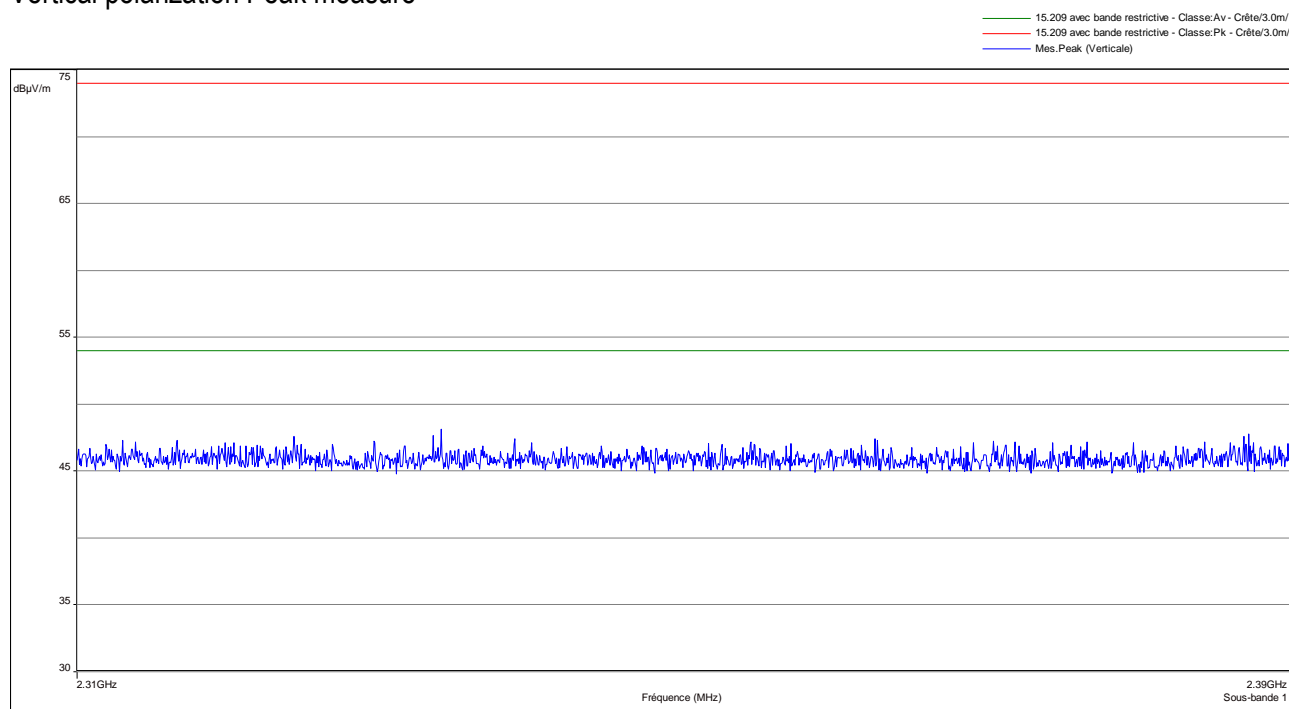
FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
200.02	QP	144	360	120	V	42.33	96.2	53.87
214.68	QP	349	207	120	H	40.34	96.2	55.86
500.02	QP	326	336	120	V	39.77	96.2	56.43
700.02	QP	400	103	120	H	36.00	96.2	60.20
900.02	QP	221	158	120	V	36.77	96.2	59.43

Sample N° 1 High channel (F=2476.35 MHz)

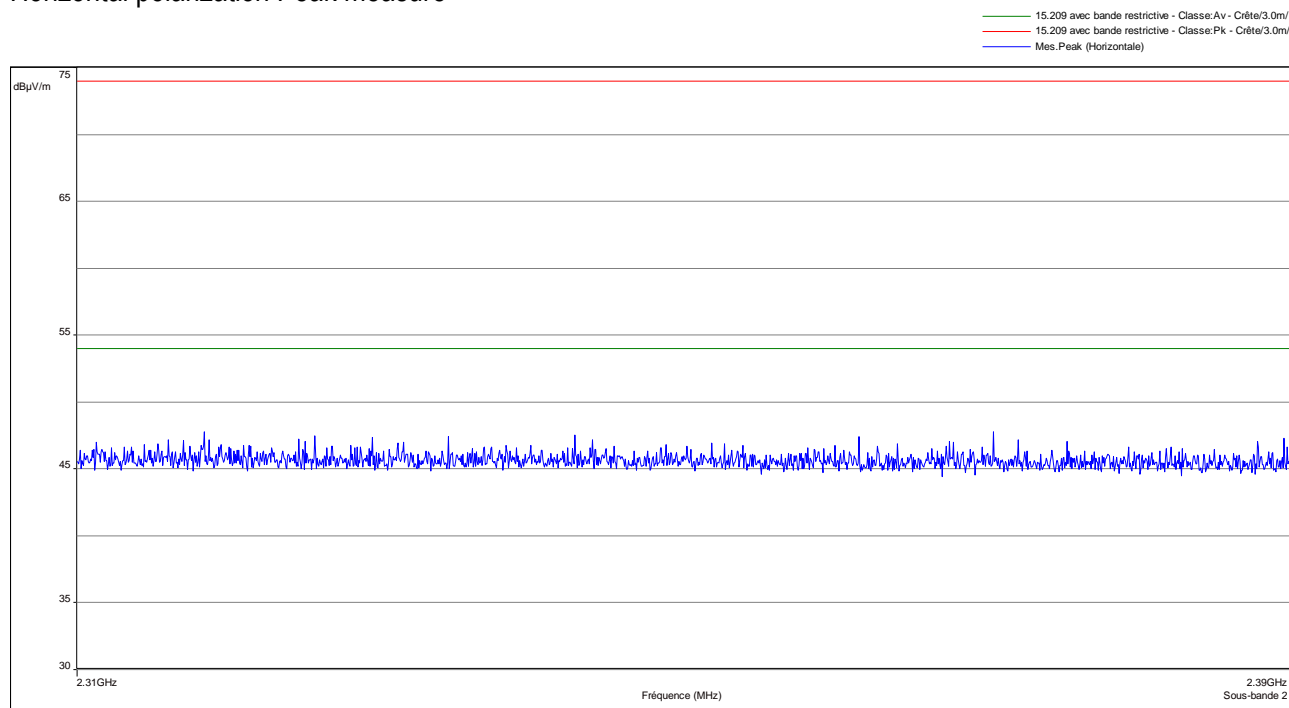
FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
200.02	QP	144	360	120	V	42.33	96.2	53.87
214.68	QP	349	207	120	H	40.34	96.2	55.86
500.02	QP	326	336	120	V	39.77	96.2	56.43
700.02	QP	400	103	120	H	36.00	96.2	60.20
900.02	QP	221	158	120	V	36.77	96.2	59.43

Spurious band 2410 - 2490 MHz

Vertical polarization Peak measure

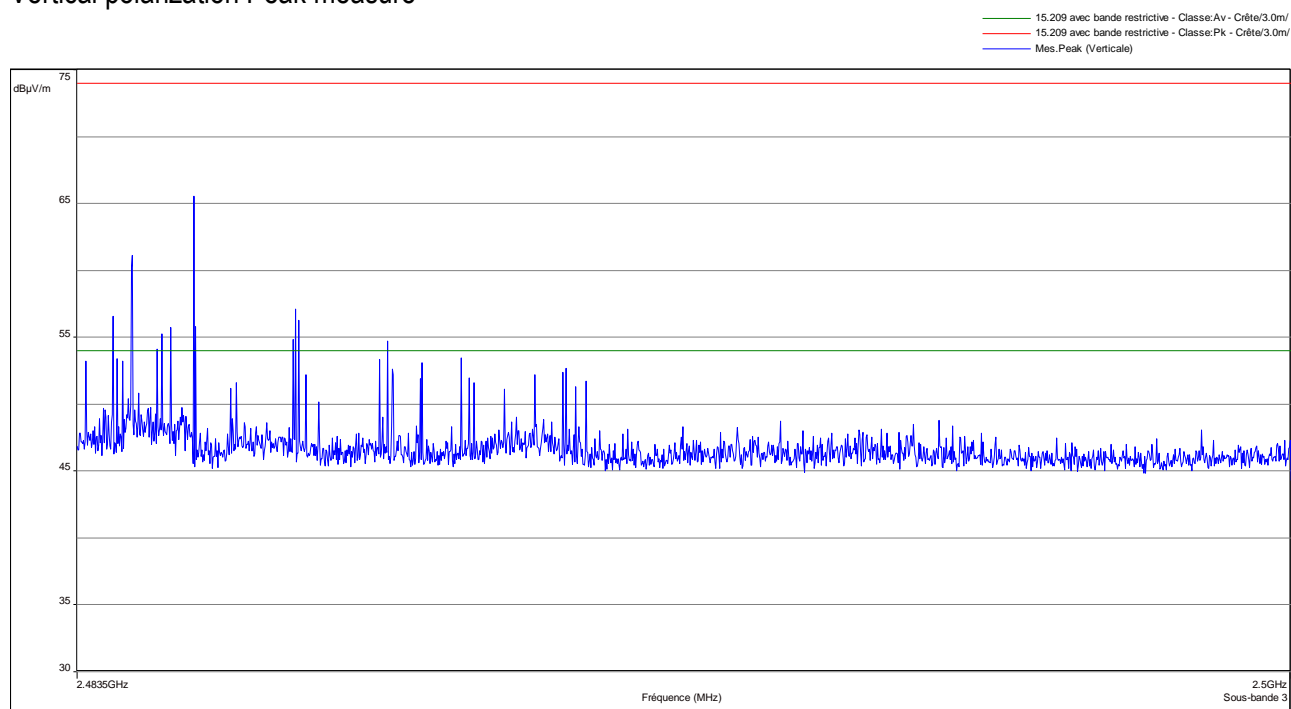


Horizontal polarization Peak measure

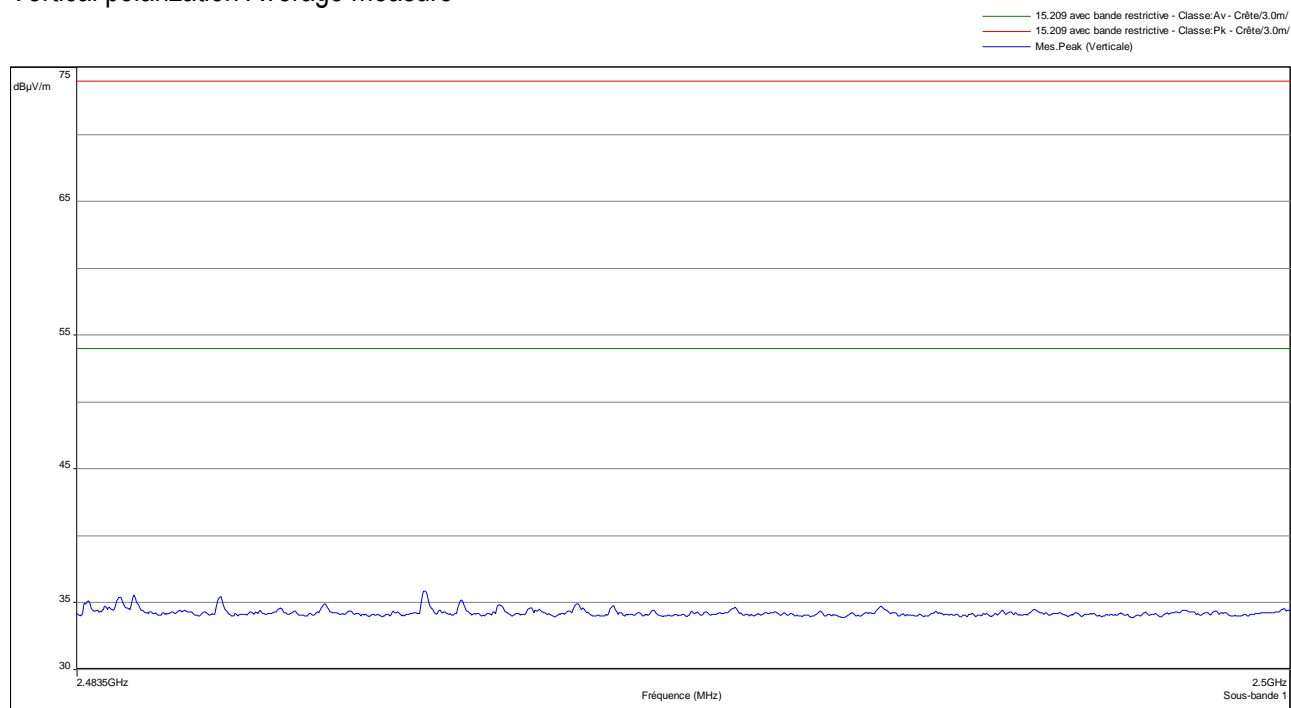


Spurious band 2483.5 - 2500 MHz

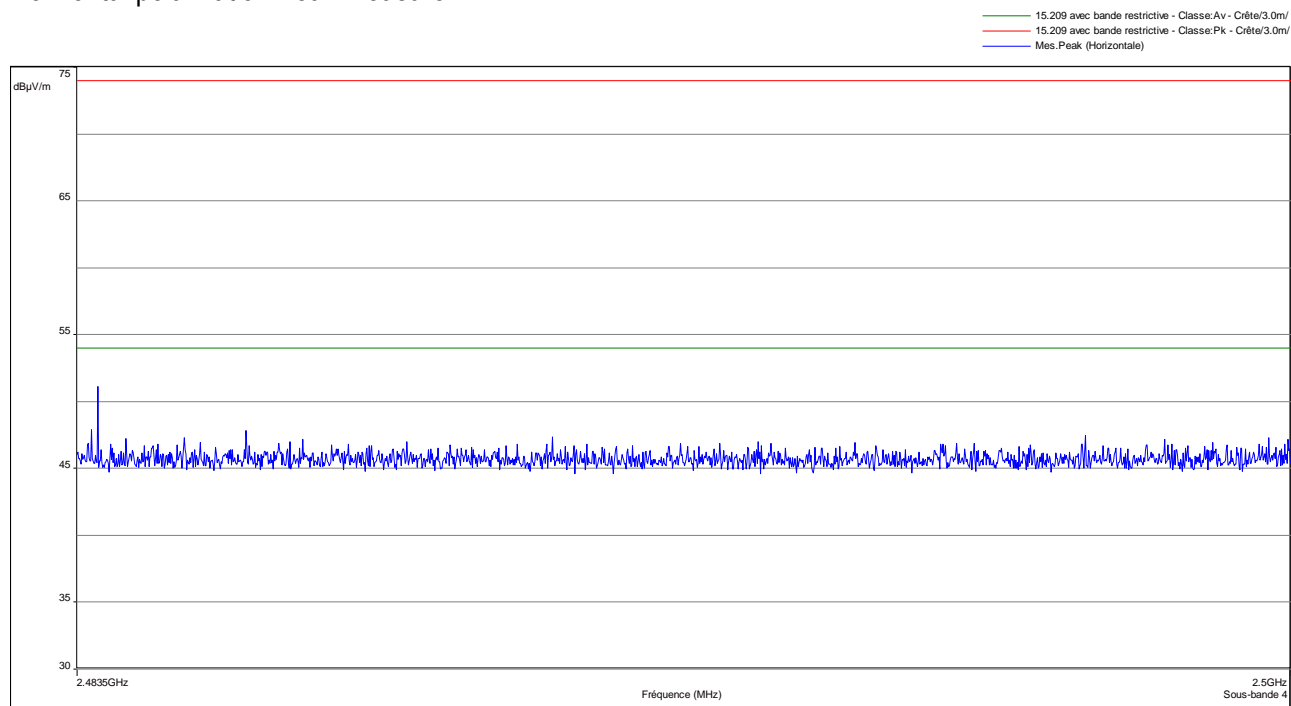
Vertical polarization Peak measure



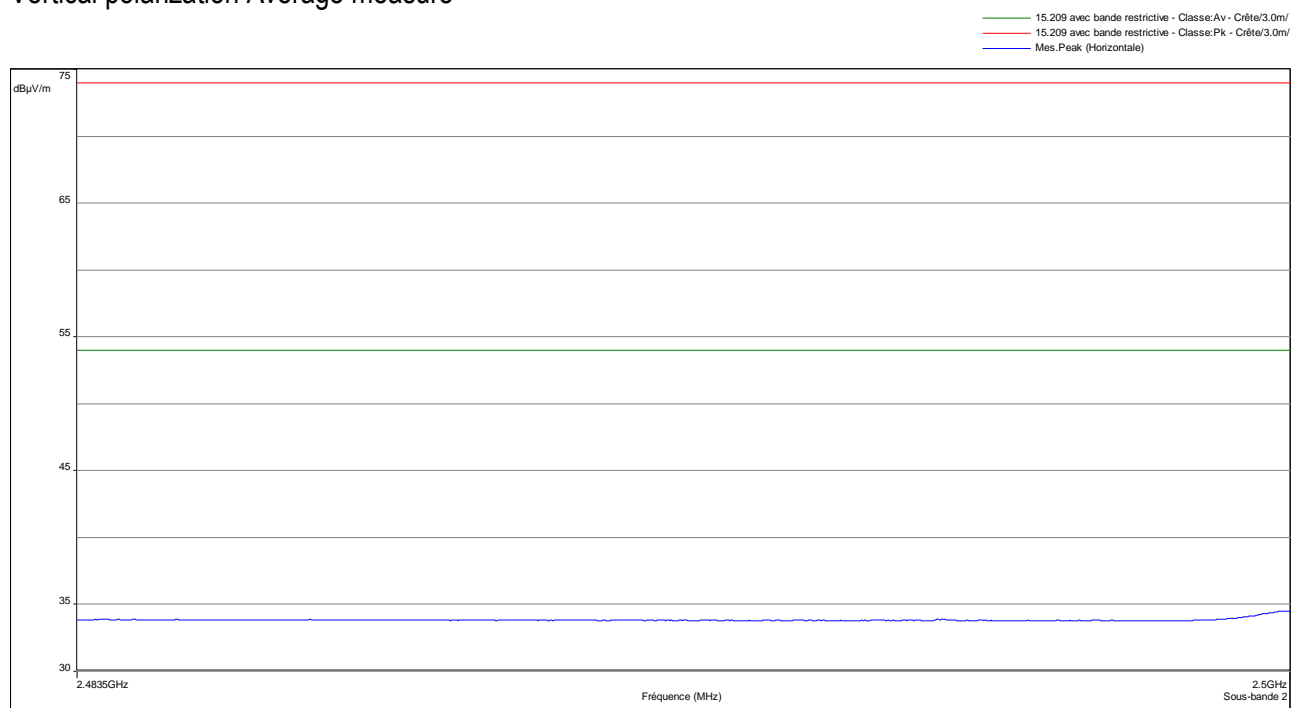
Vertical polarization Average measure



Horizontal polarization Peak measure

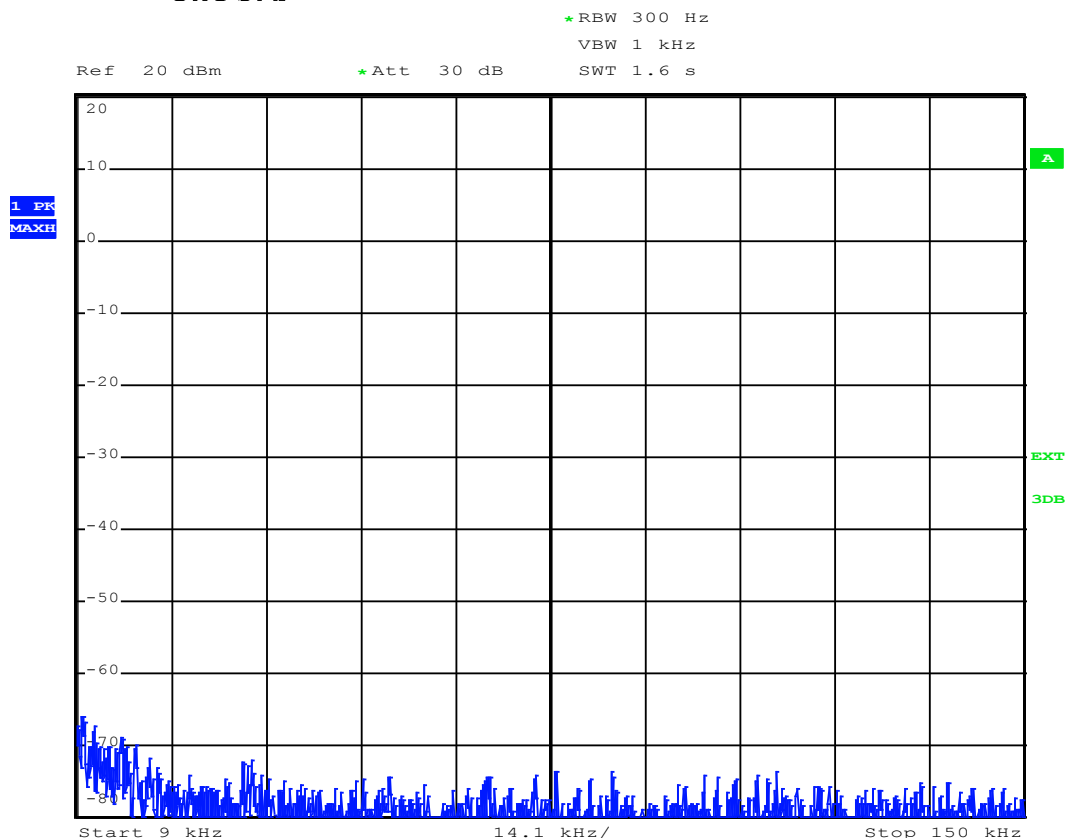


Vertical polarization Average measure



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

Curve with signal at antenna connector are given in appendix 10



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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 20 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 116.2 dB μ V/m on low channel.
So the applicable limit is 96.2 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

□□□ End of report, 9 annexes to be forwarded □□□

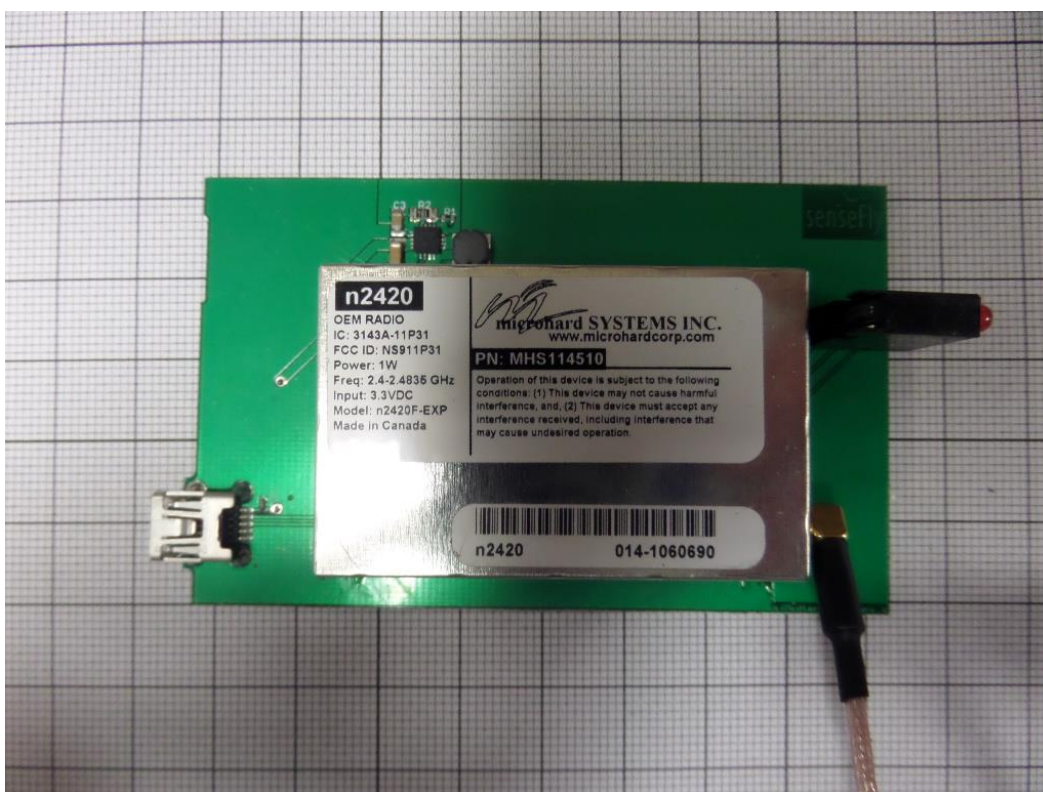
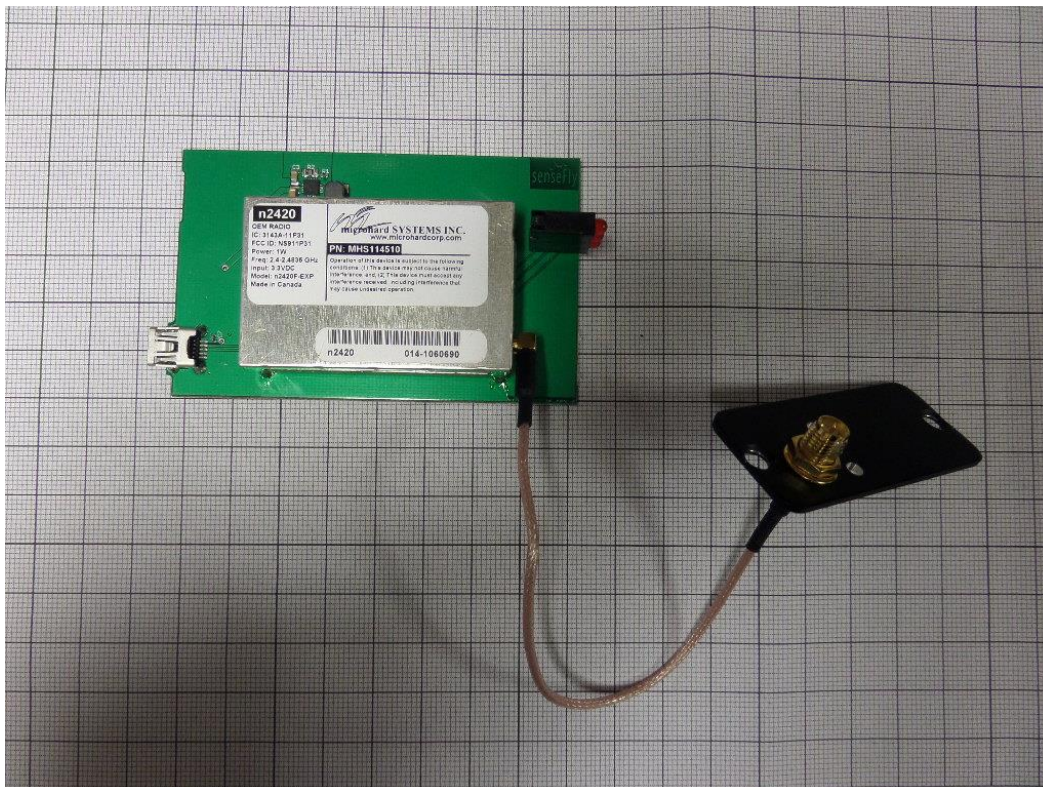
APPENDIX 1: Photos of the equipment under test

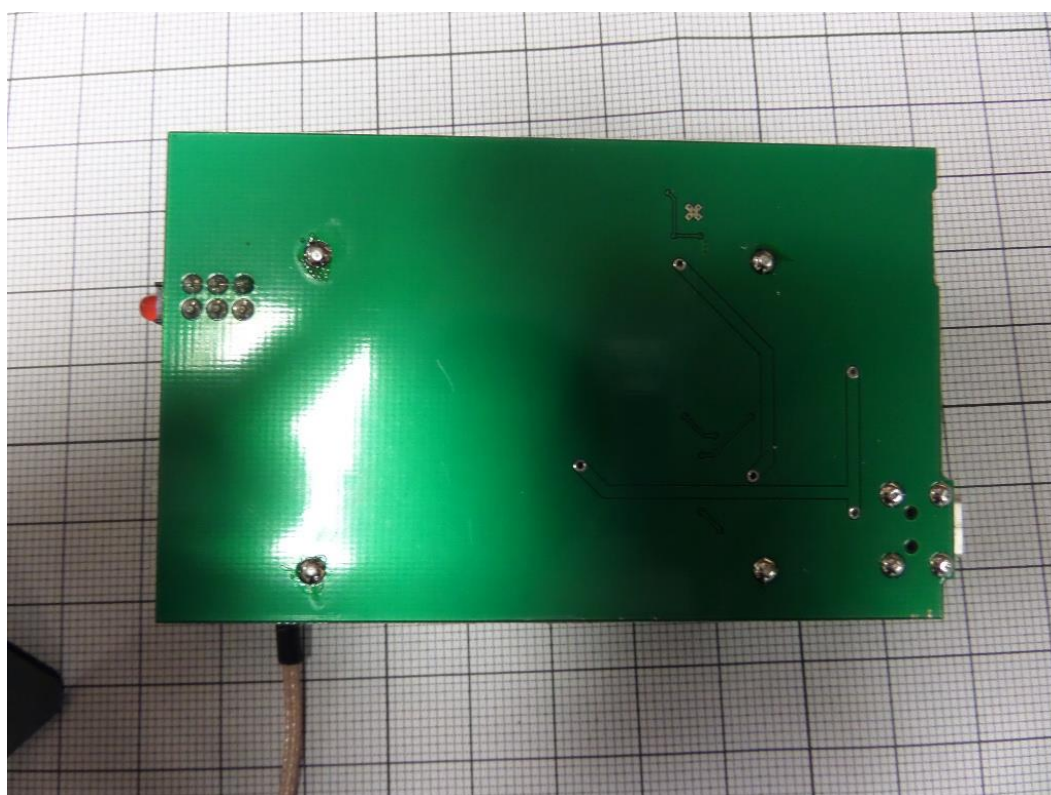
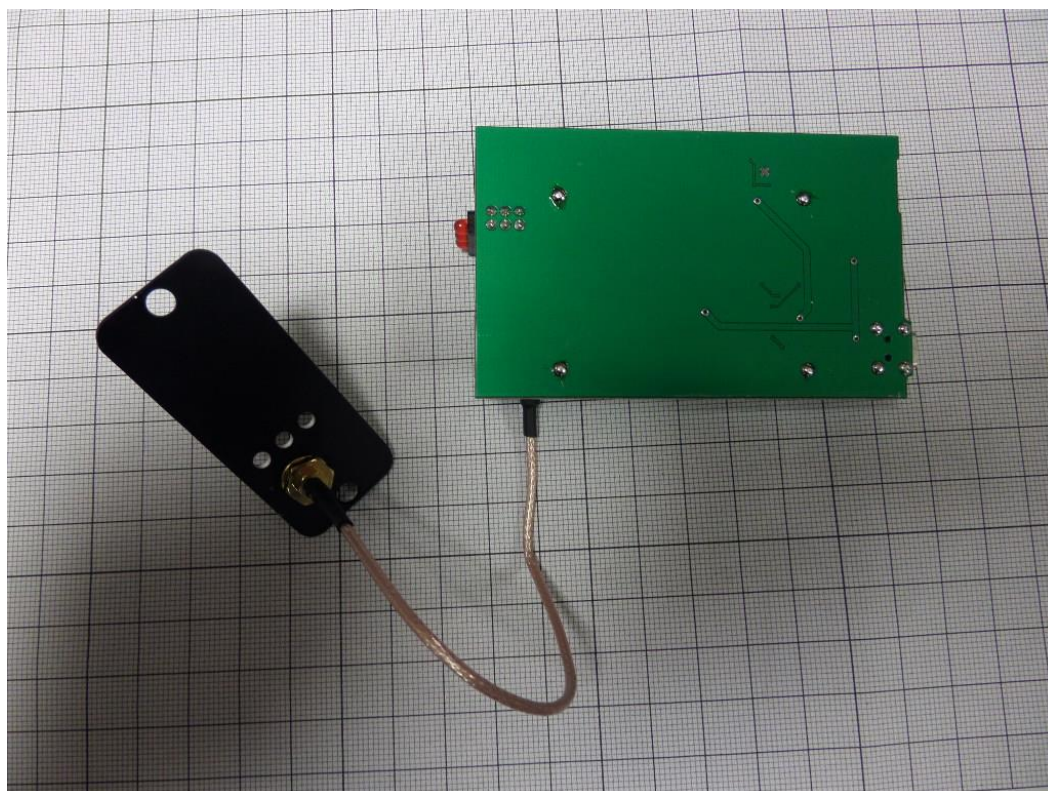
General view





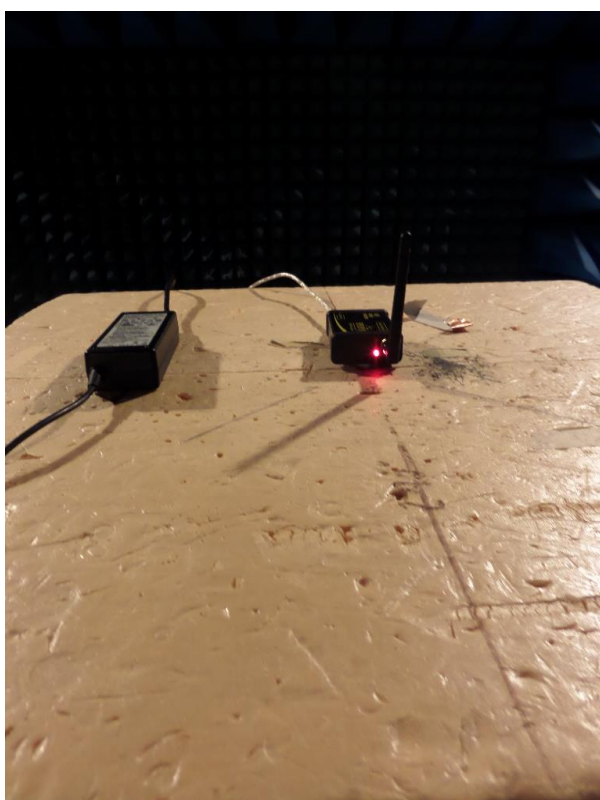
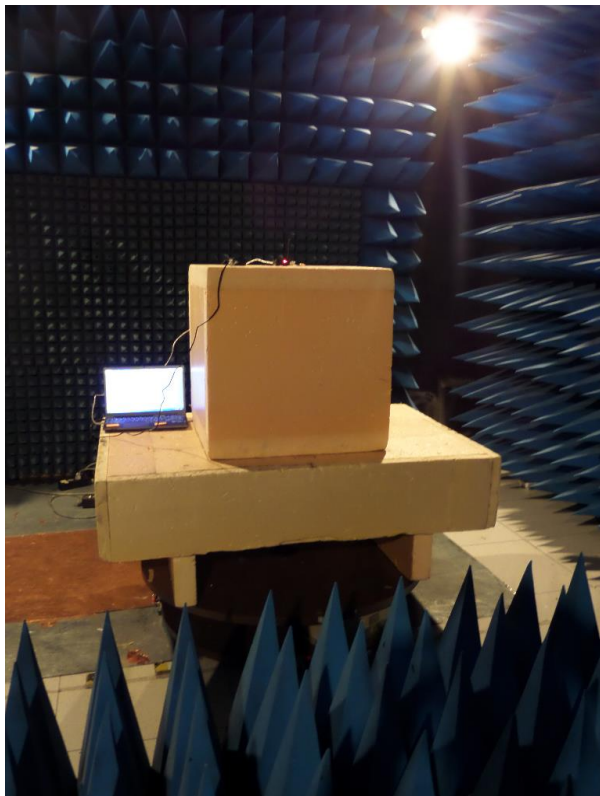
Internal view





APPENDIX 2: Test set up

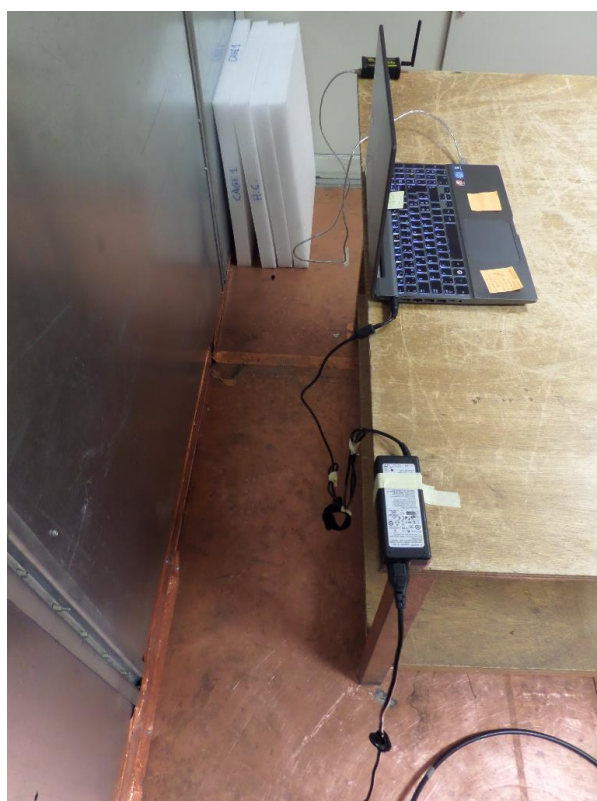
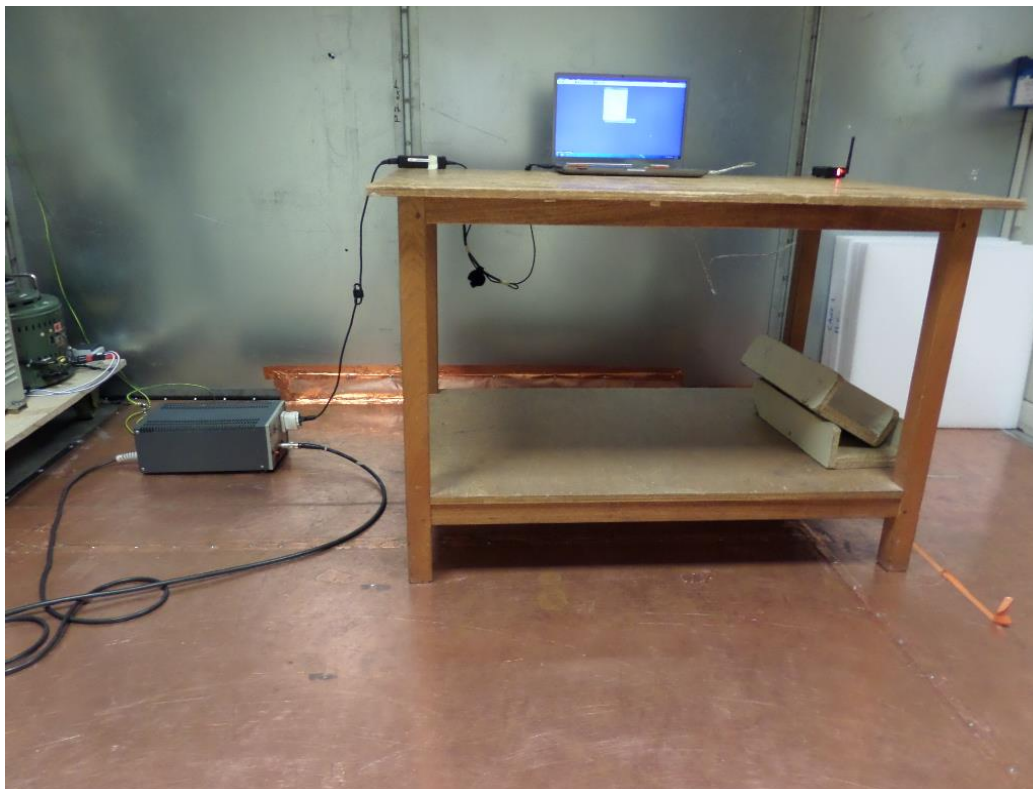
In anechoic room



In open area test site



Conducted measurements



APPENDIX 3: Test equipment list

Measurement of the conducted disturbances

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	8893
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
LISN ESH2-Z5	Rohde & Schwarz	8719
High-pass filter EZ-25	Rohde & Schwarz	8635
Absorber sheath current	Emitech	9489
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8677
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

Radiated emission limits

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Log periodic antenna 3147	EMCO	8783
Antenna 3115	Electrometrics	8535
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier C020180F-4B1	Microwave DB	1922
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8677
Multimeter 177	Fluke	10317
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	Champ libre Juigné. V3.4	8864

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	Electrometrics	8535
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8677
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBSHOT V2.4	-

Maximum peak output power

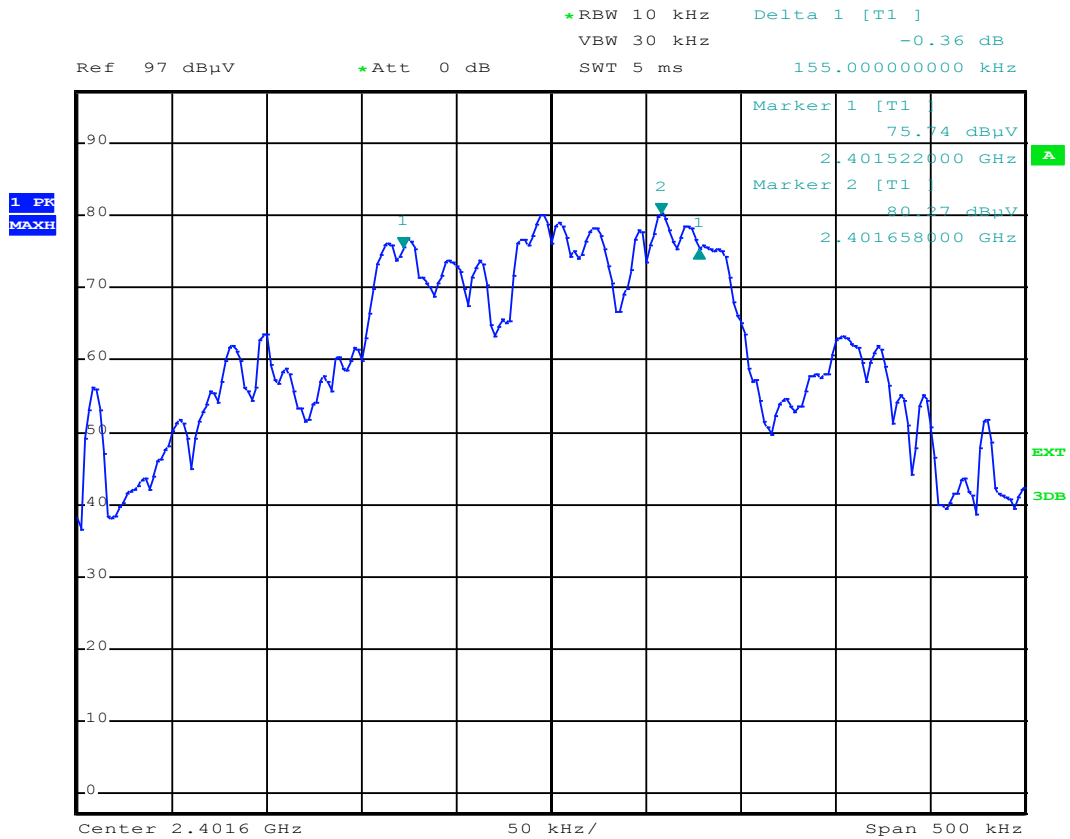
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	Electrometrics	8535
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8677
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

Intentional radiator

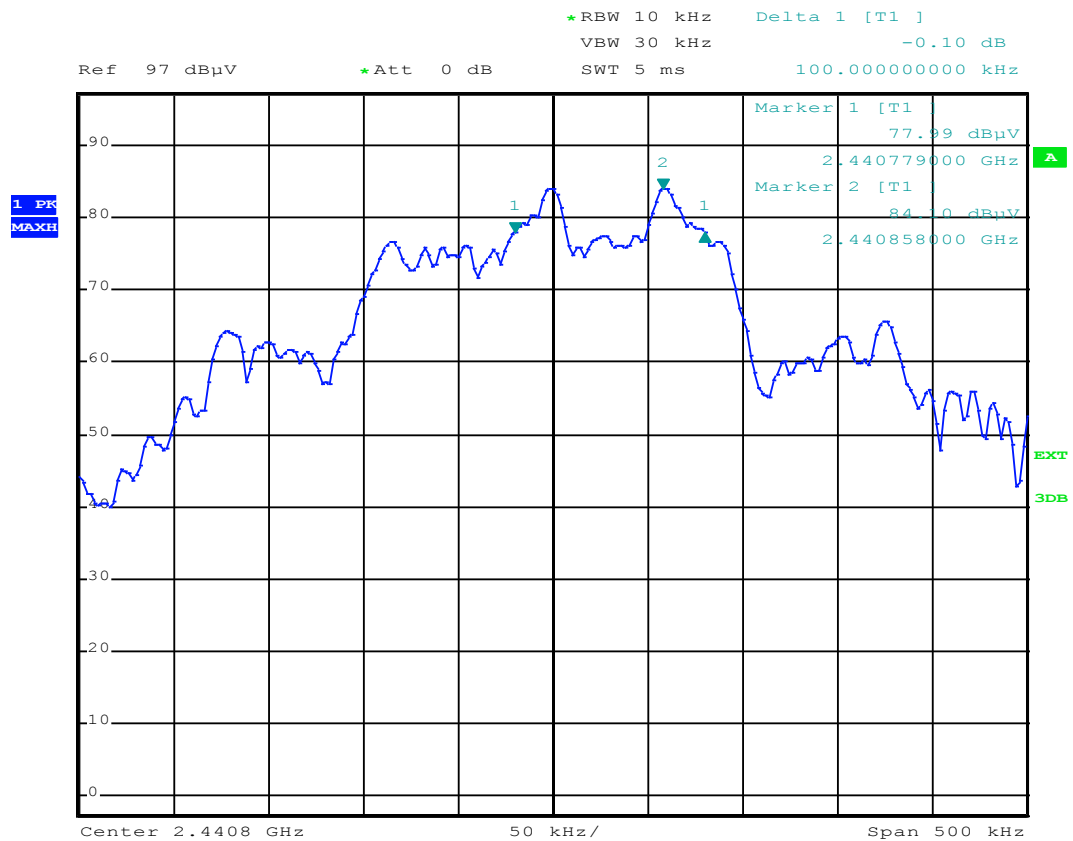
TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna HFH2-Z2	Rohde & Schwarz	8533
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Log periodic antenna 3147	EMCO	8783
Antenna 3115	Electrometrics	8535
Antenna WR42	IMC	1939
Antenna WR42	IMC	1940
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier C020180F-4B1	Microwave DB	1922
Low-noise amplifier ALN02-0102	ALC Microwave	3036
Reject band filter BRM50702	Microtronics	7299
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8677
Multimeter 177	Fluke	10317
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	Champ libre Juigné. V3.4	8864

APPENDIX 4: 6 dB bandwidth

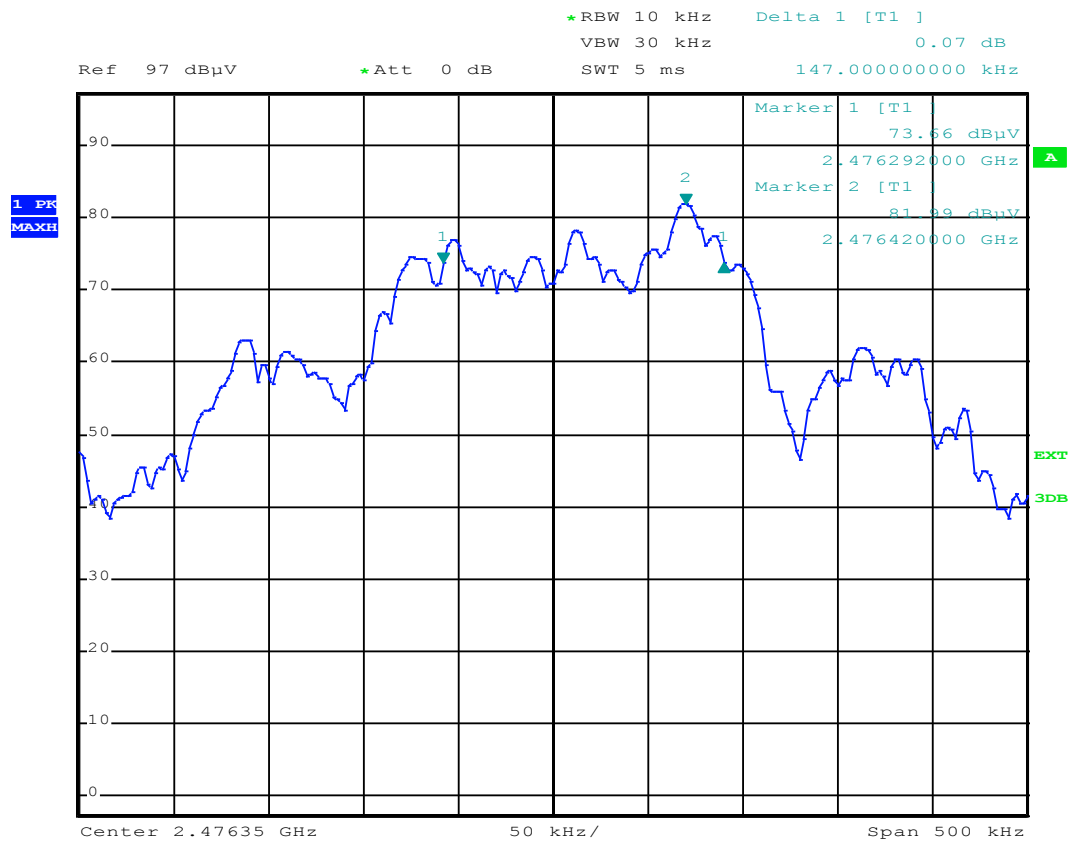
Low channel



Central channel

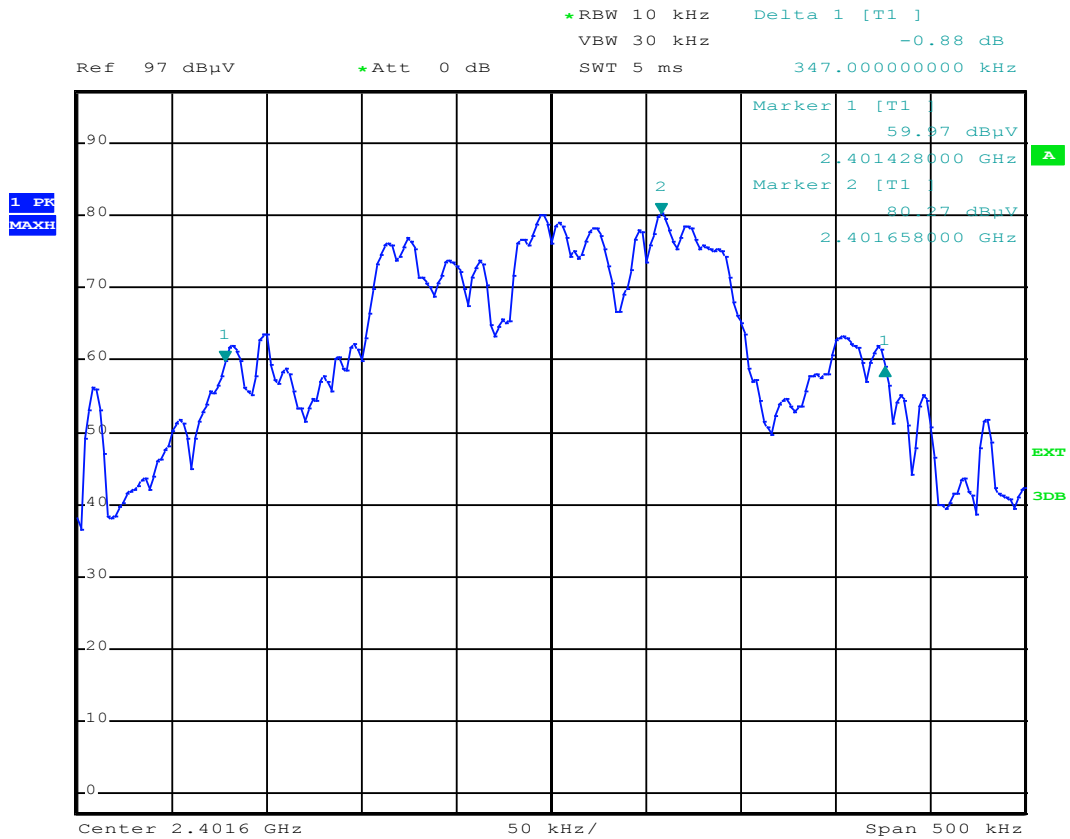


High channel

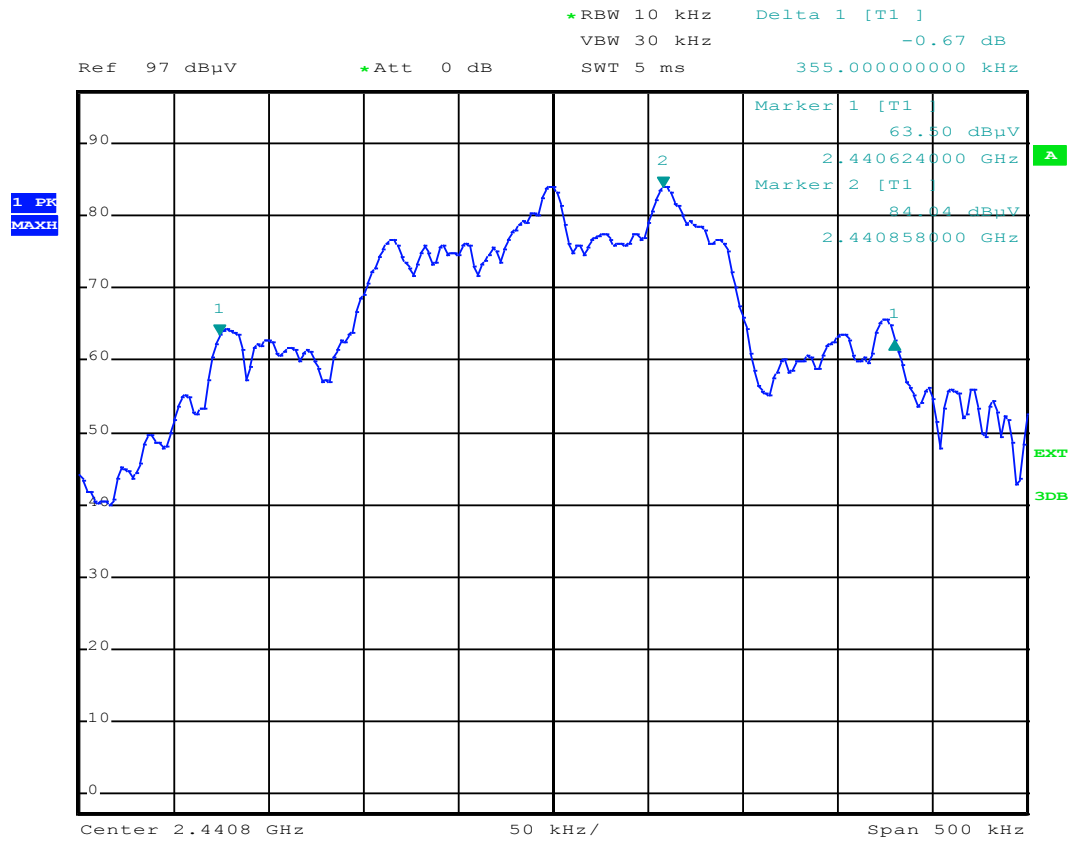


APPENDIX 5: 20 dB bandwidth

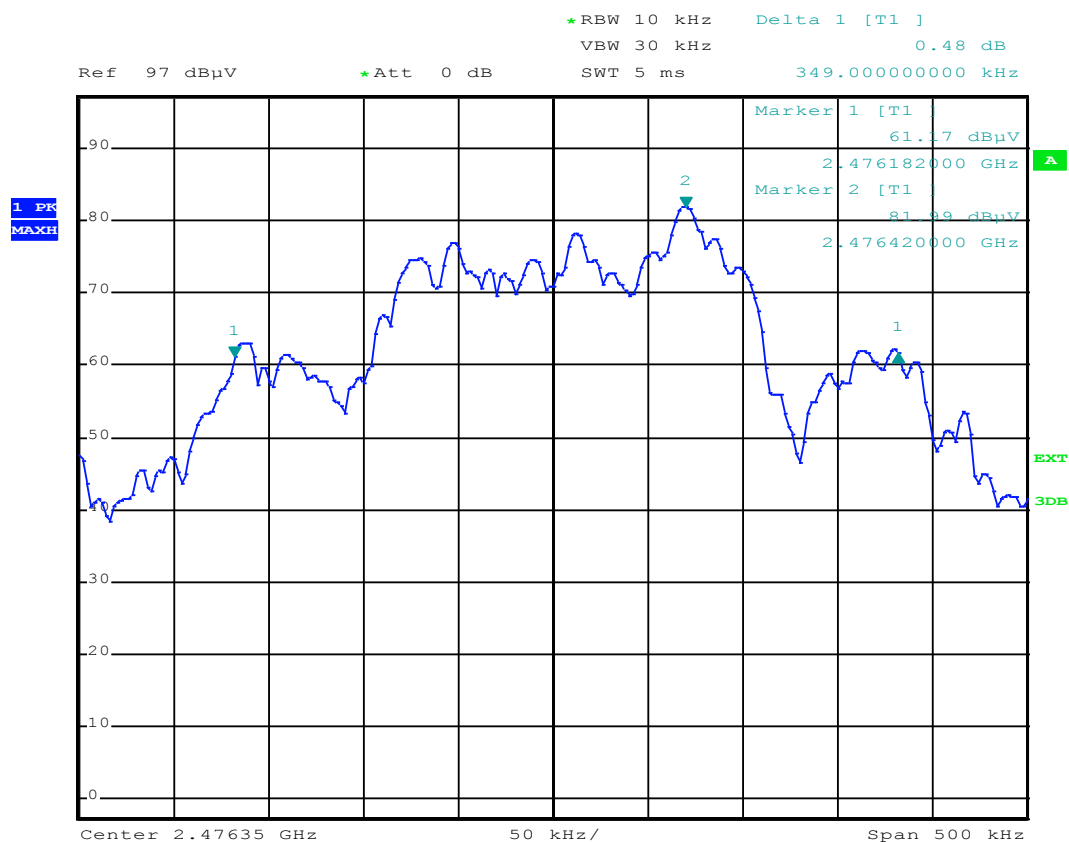
Low channel



Central channel

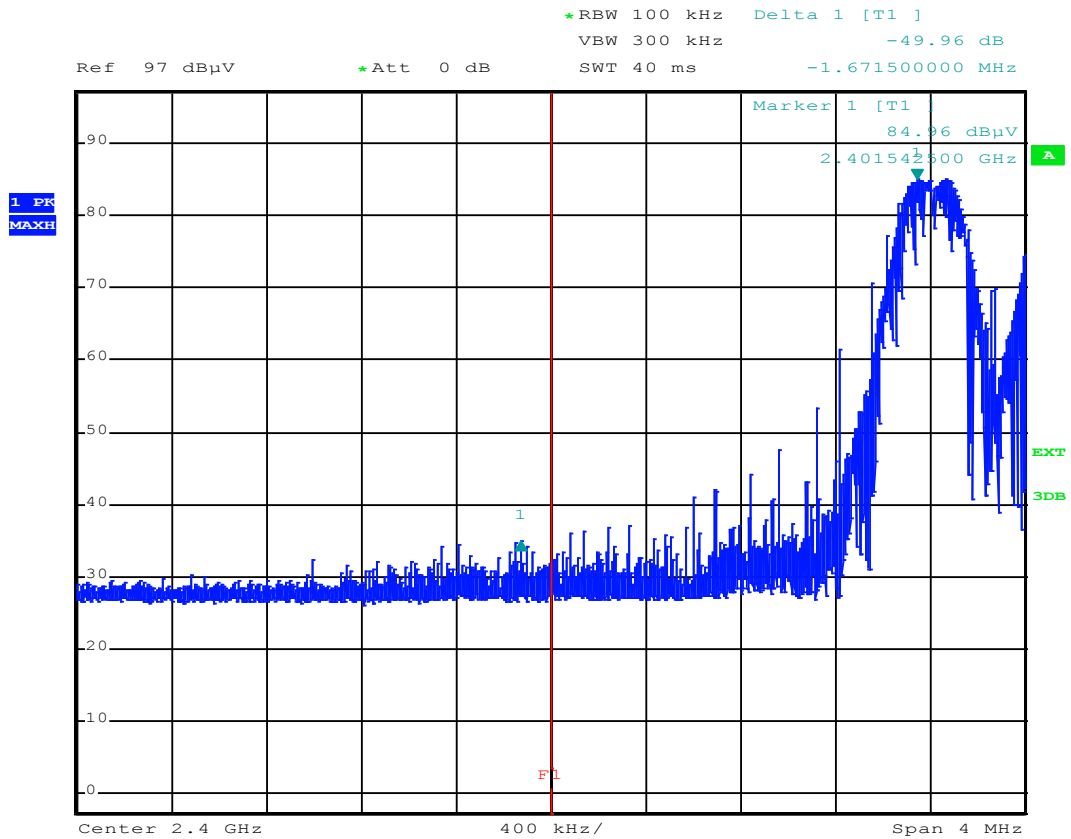


High channel

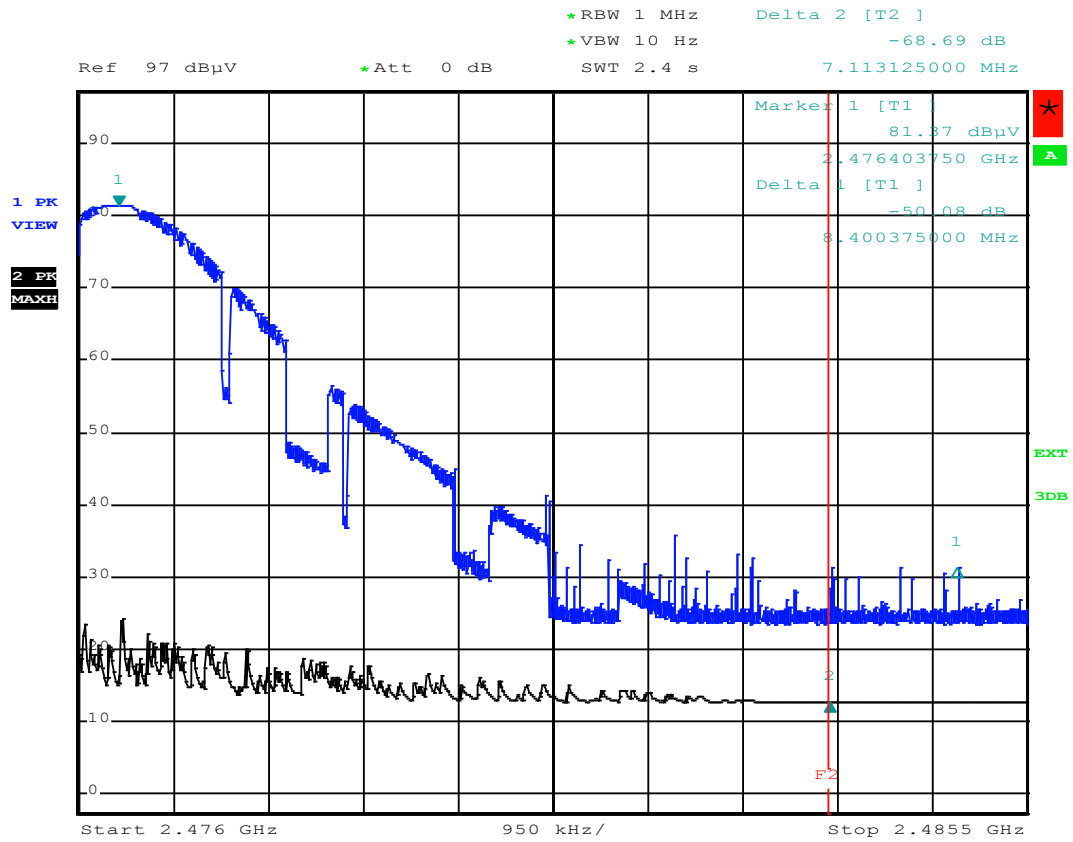


APPENDIX 6: Band edge

Low channel

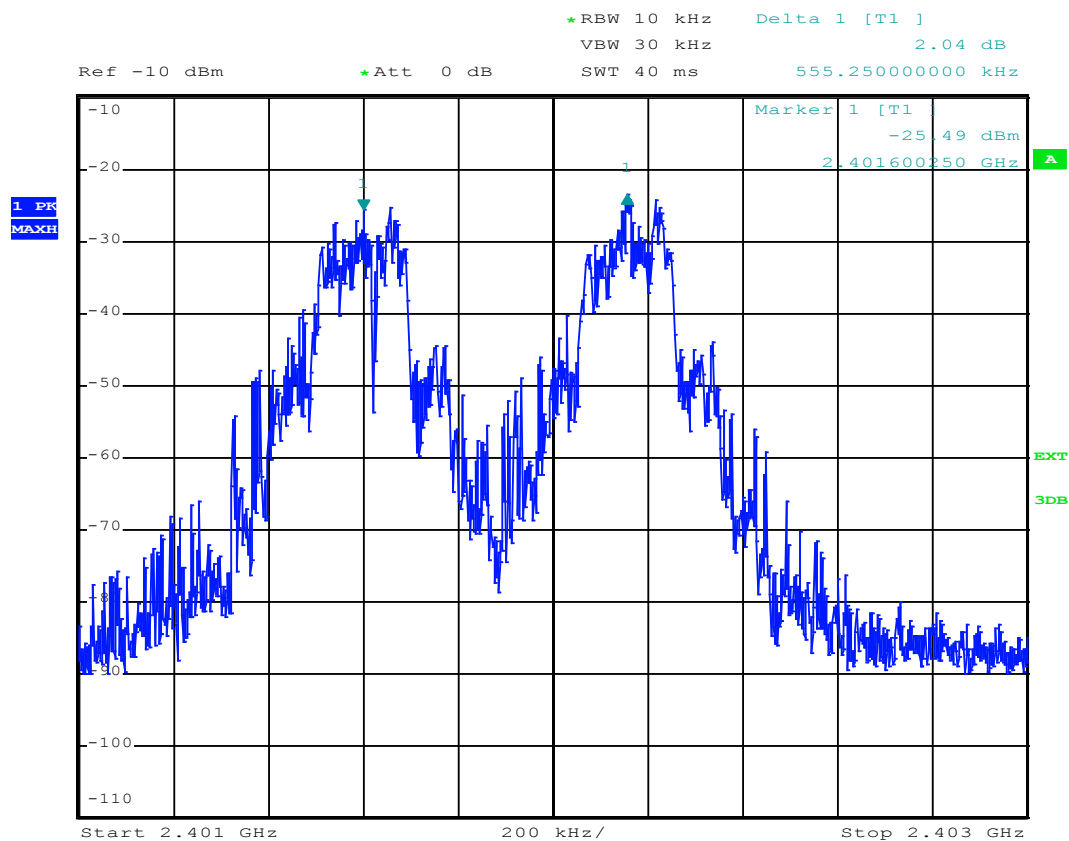


High channel

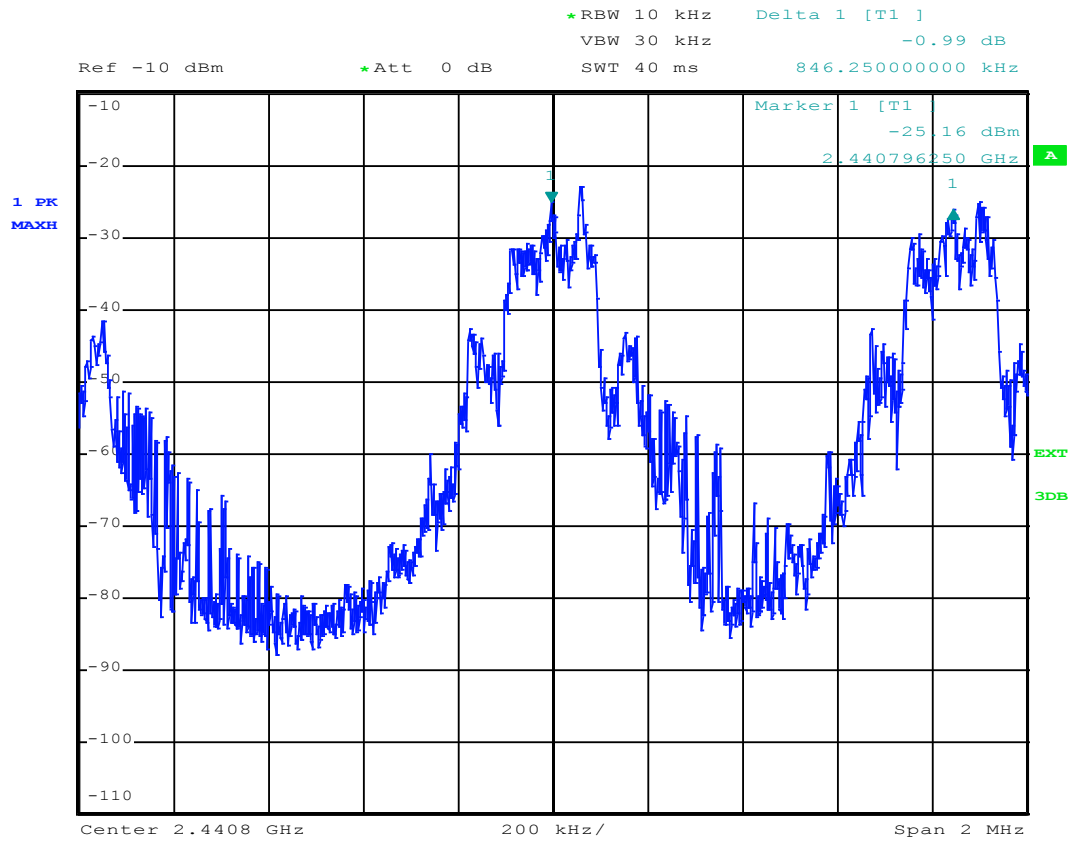


APPENDIX 7: Channel spacing

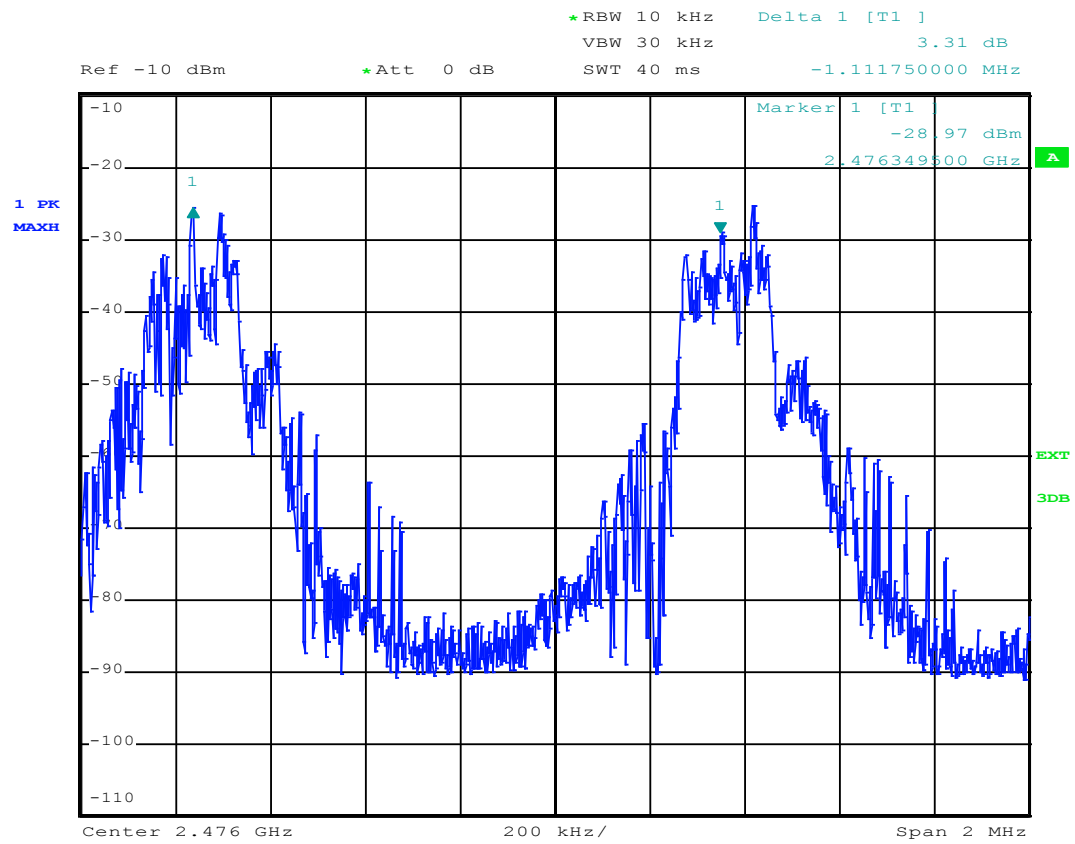
Low channel



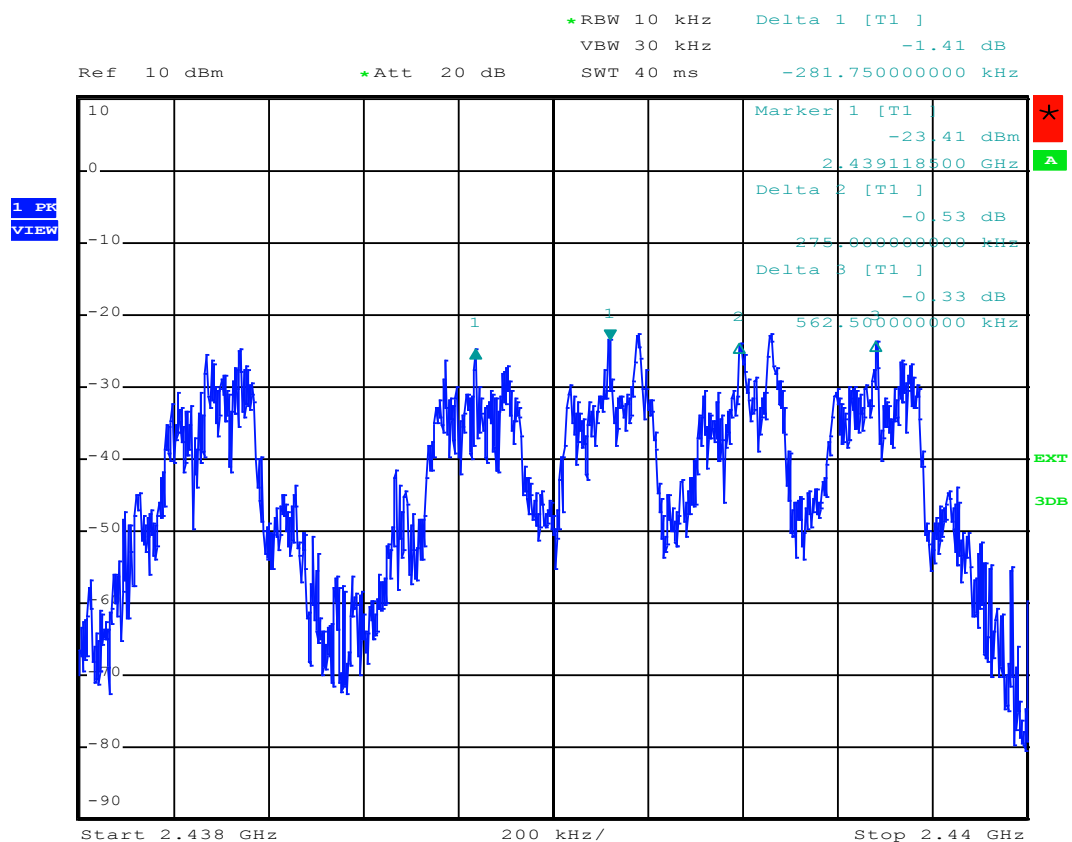
Central channel



High channel

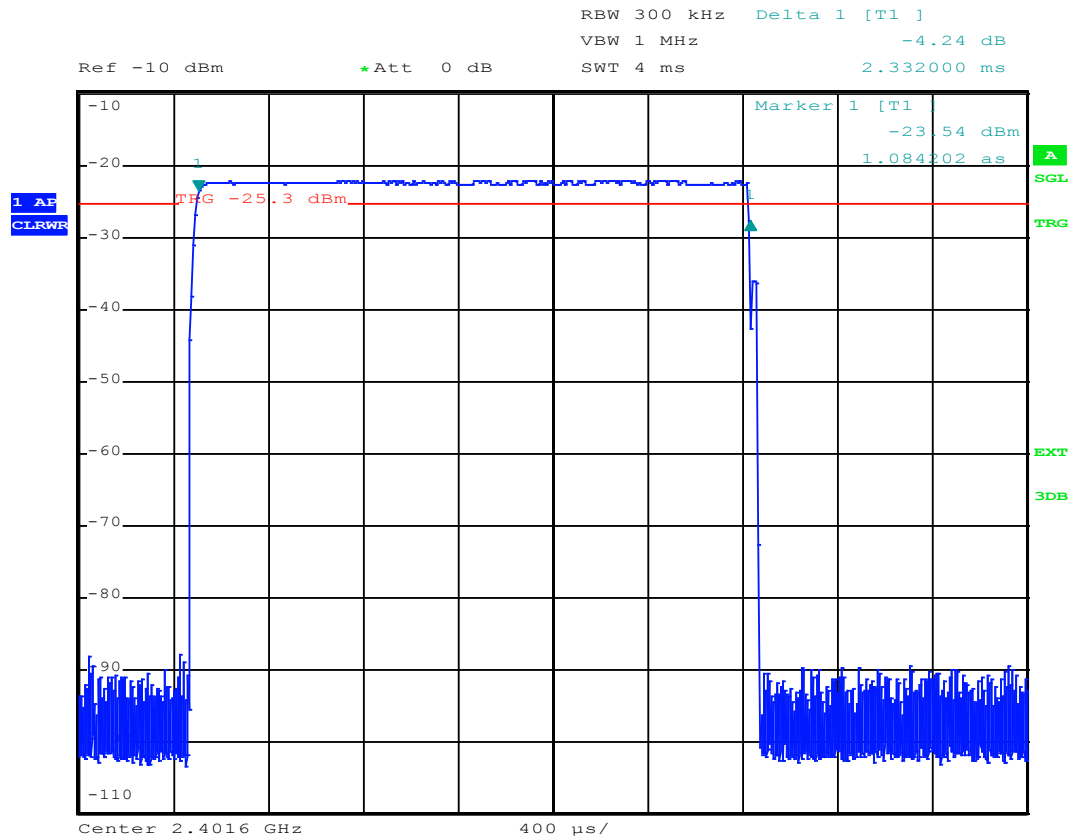


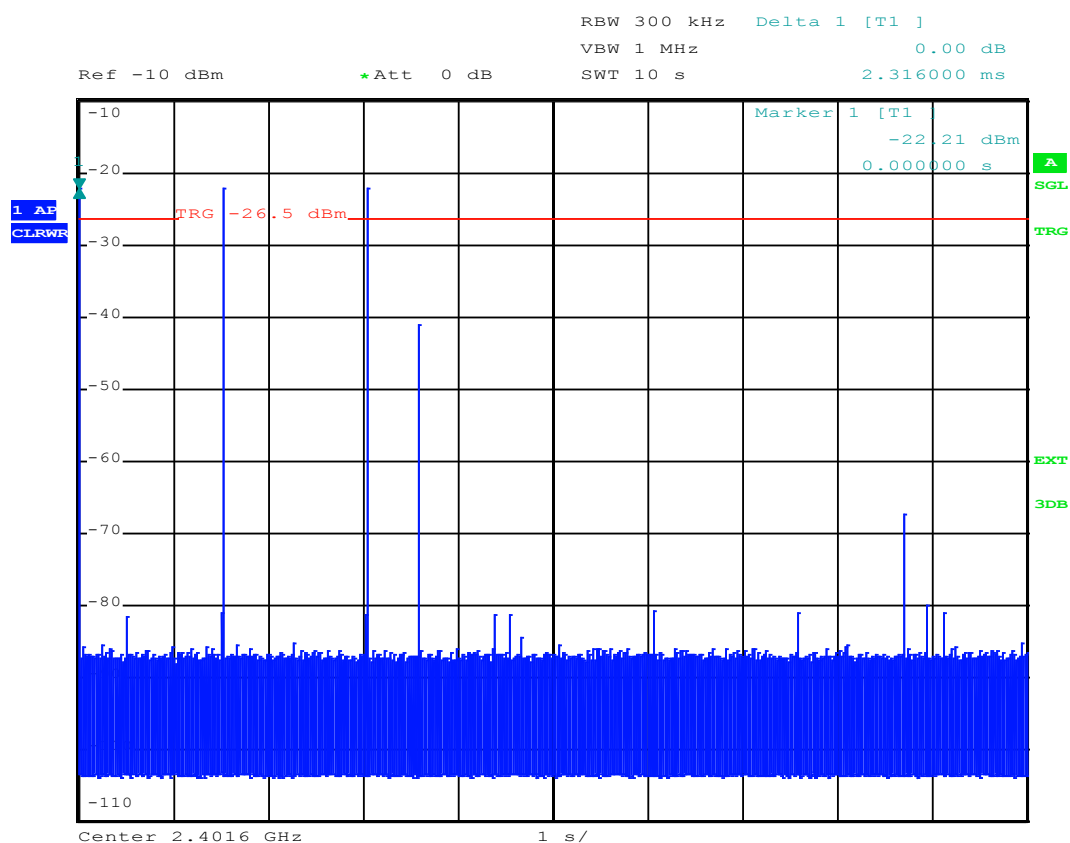
Minimum channel spacing



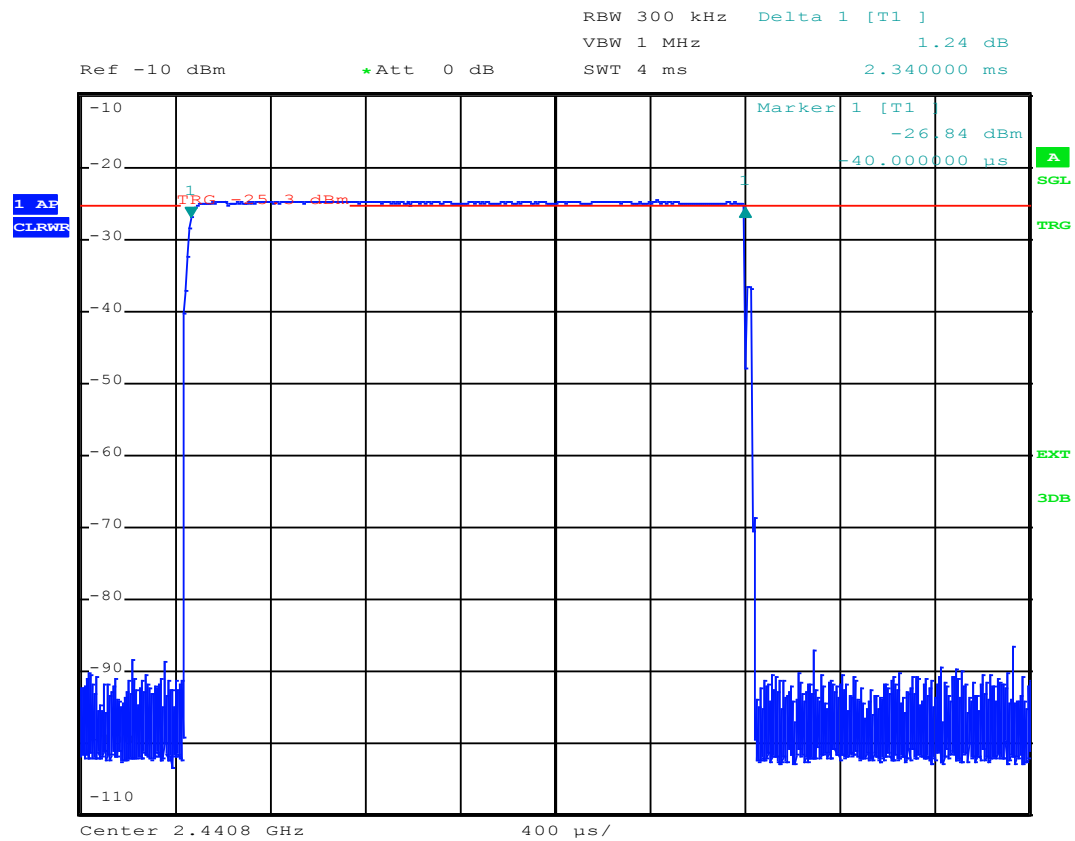
APPENDIX 8: Time of occupancy on any frequency

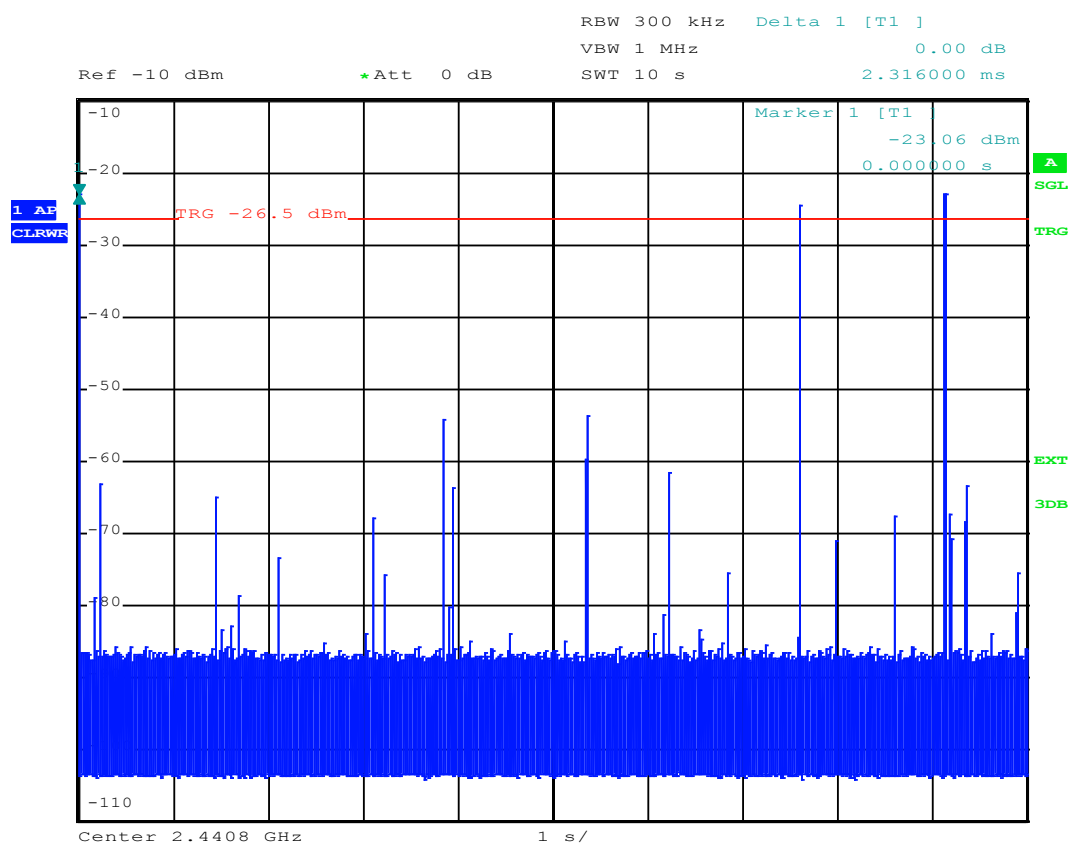
Low channel



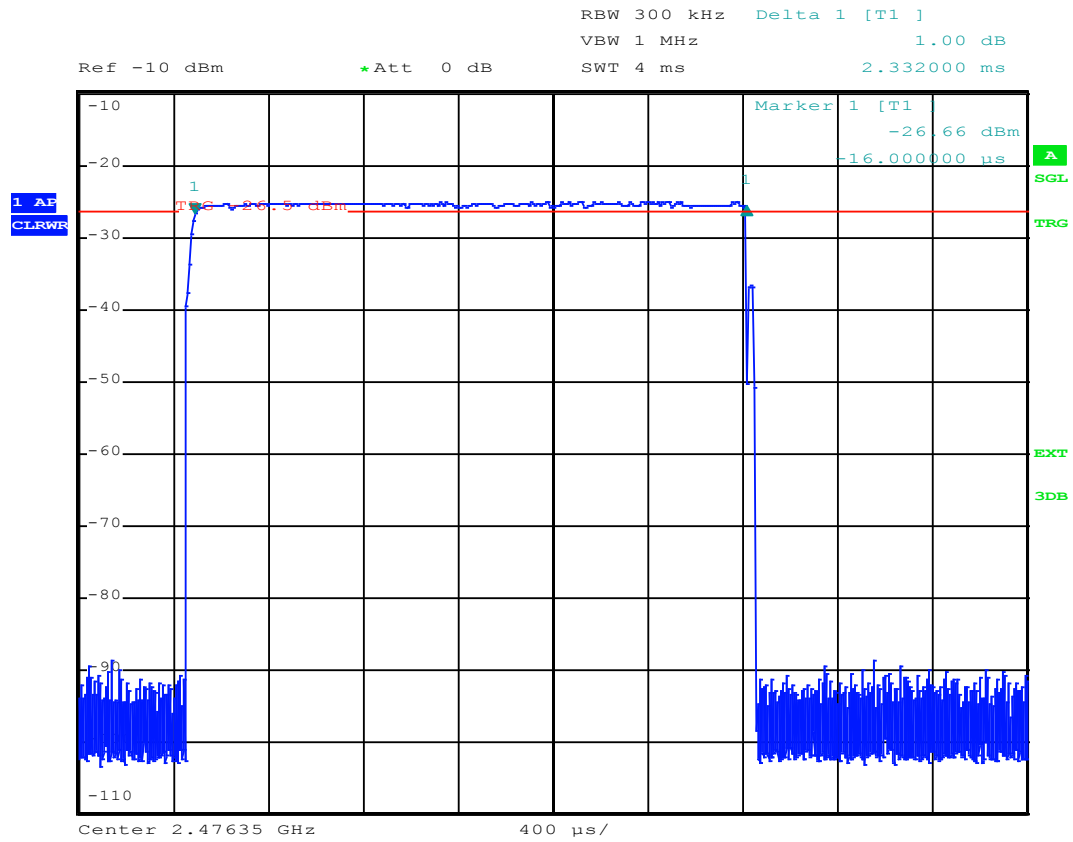


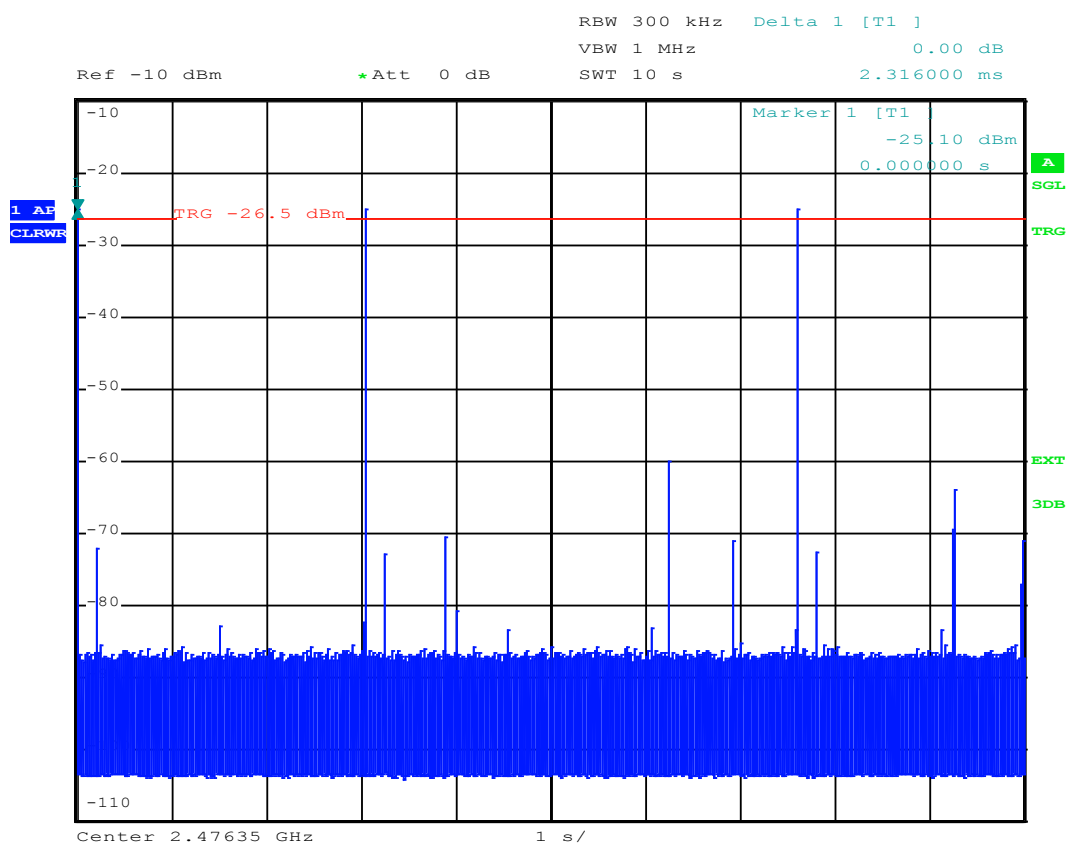
Central channel



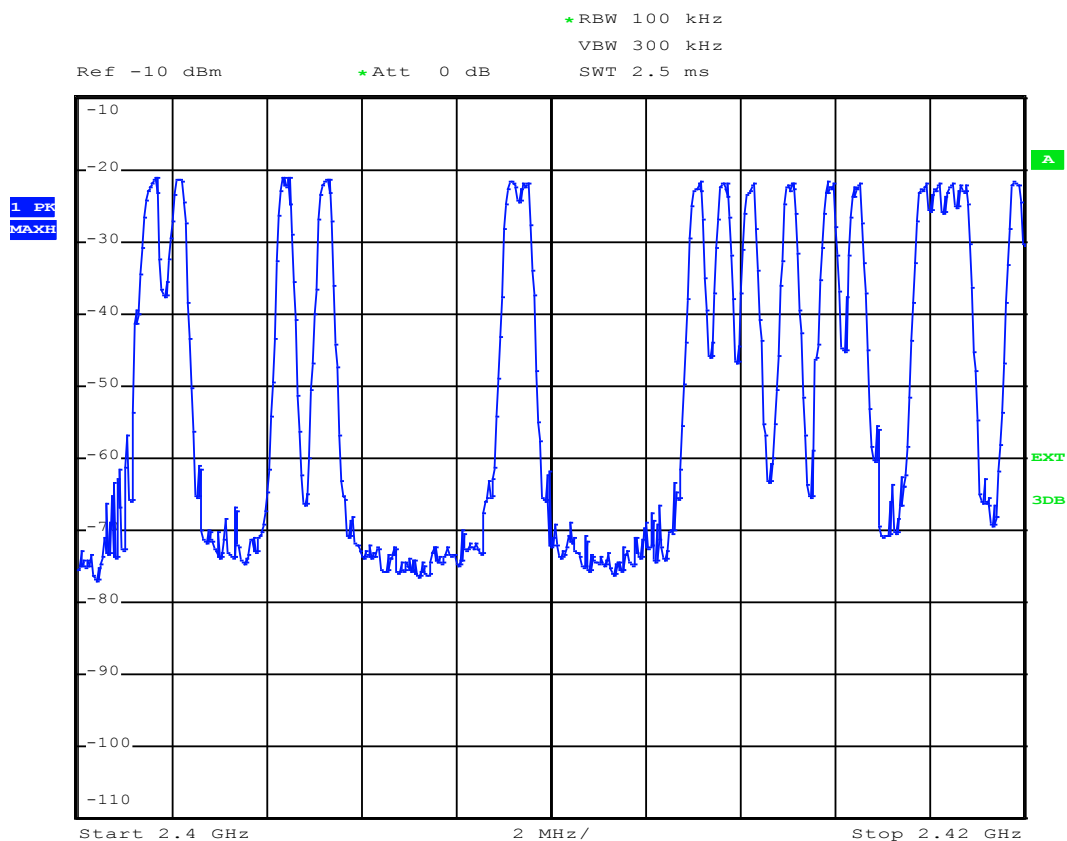


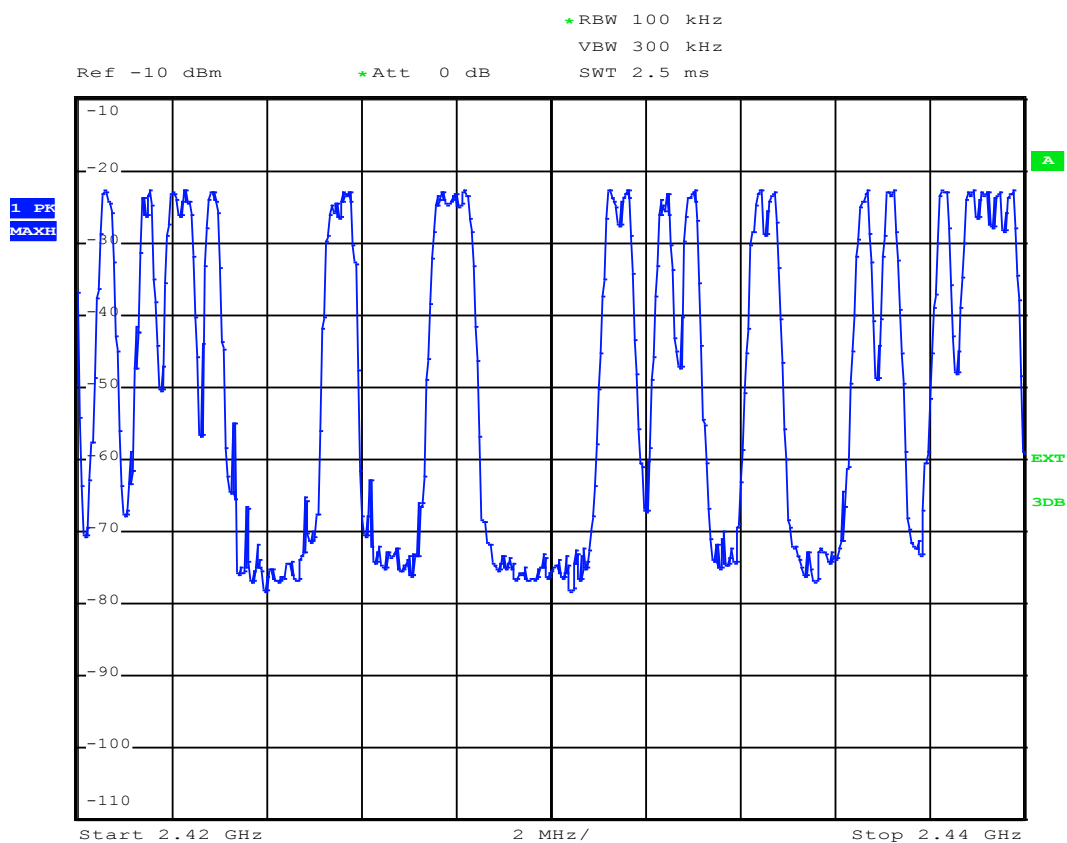
High channel

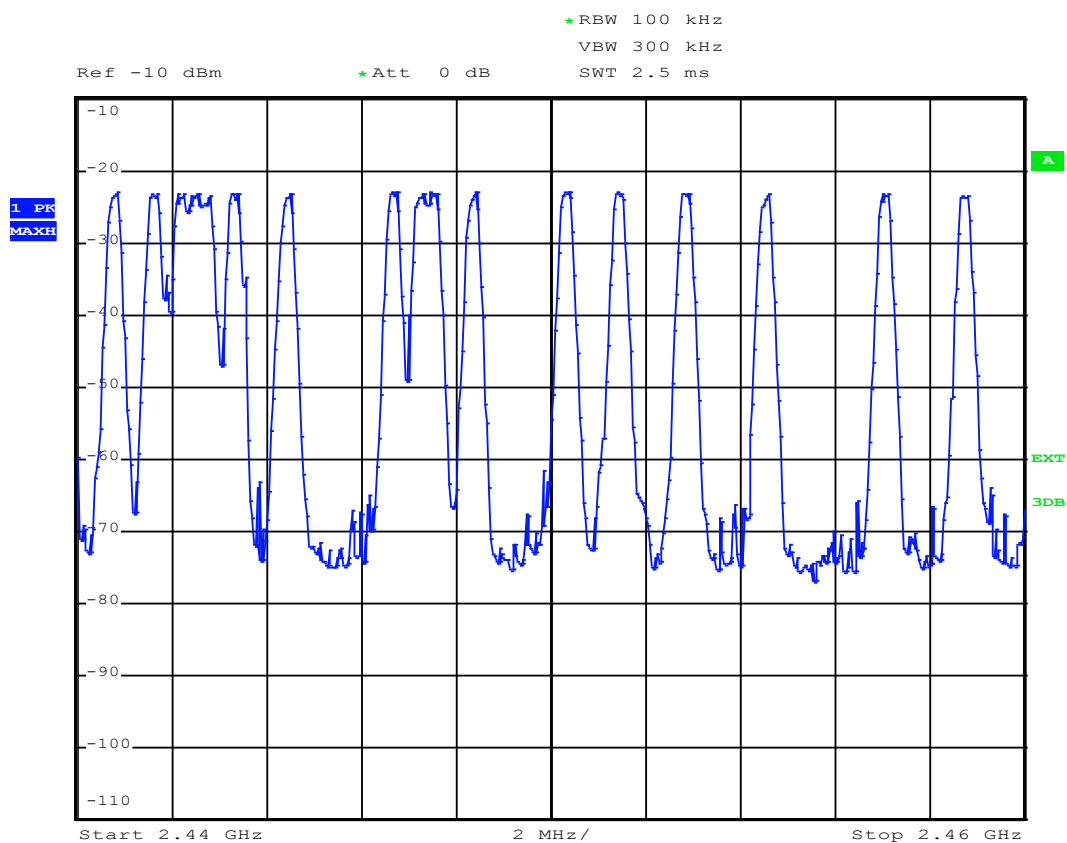


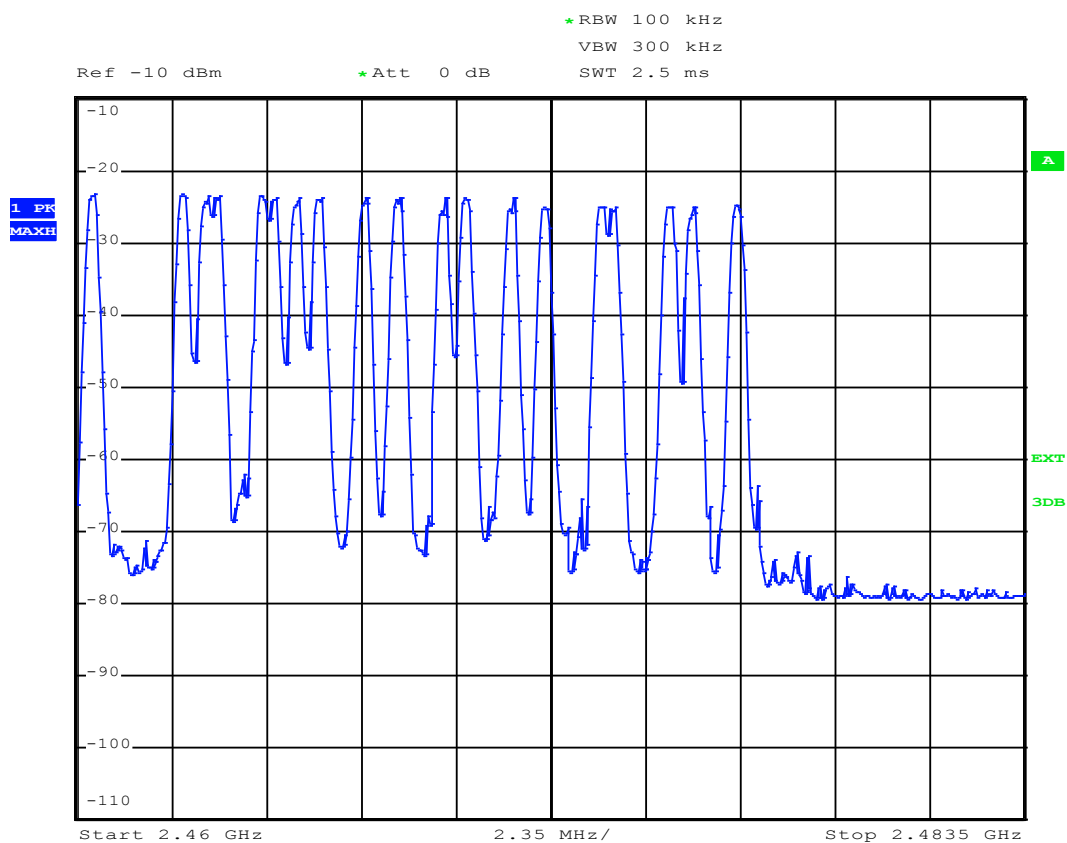


APPENDIX 9: Number of hopping channels

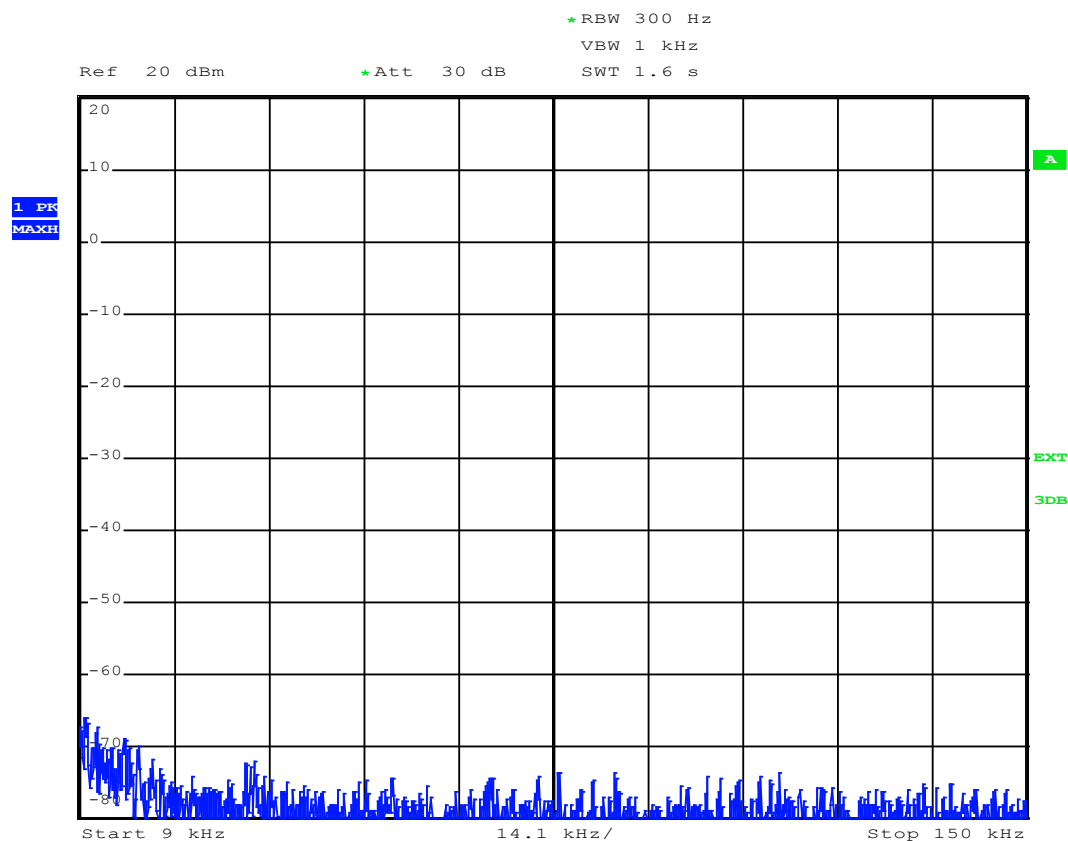




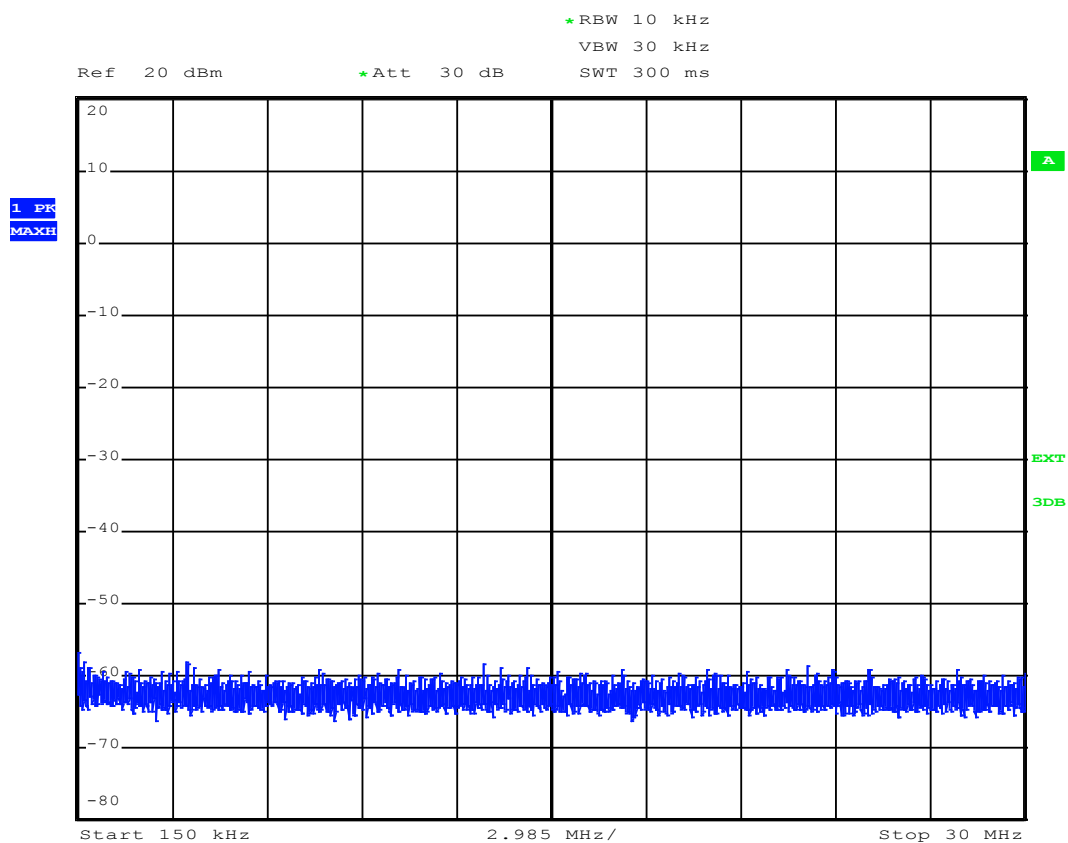




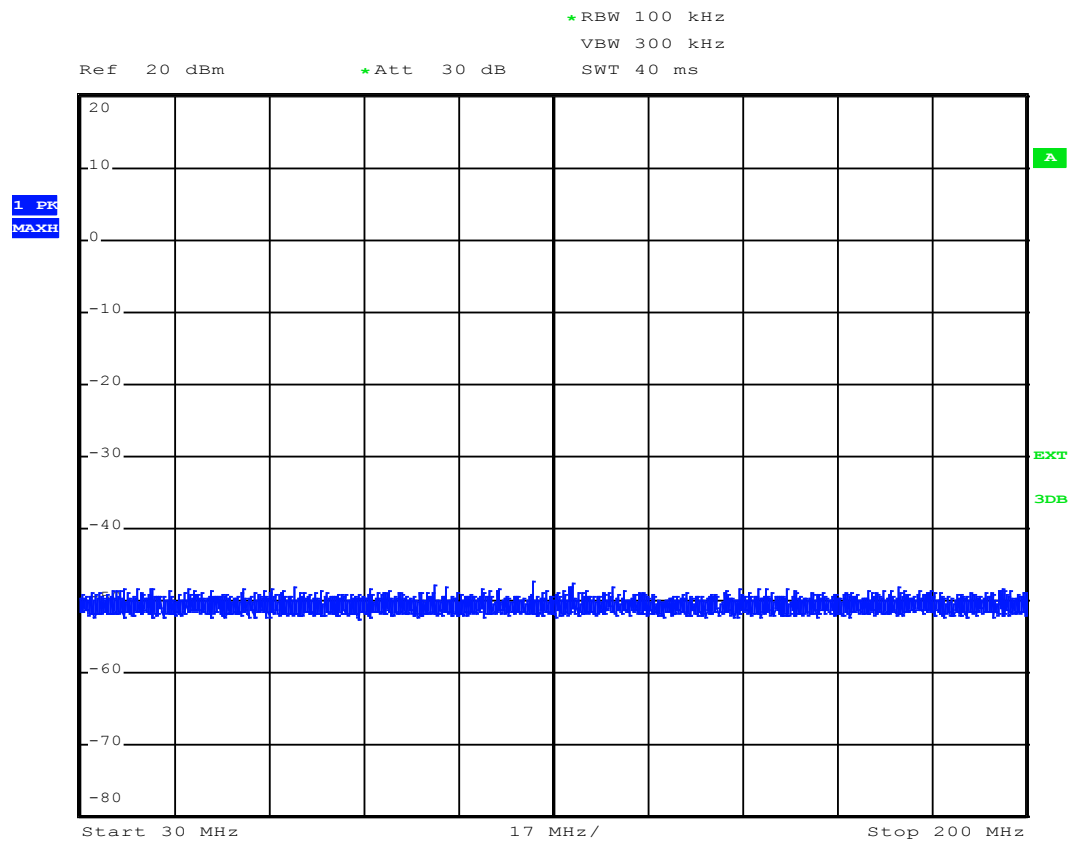
APPENDIX 10: Signal at antenna connector



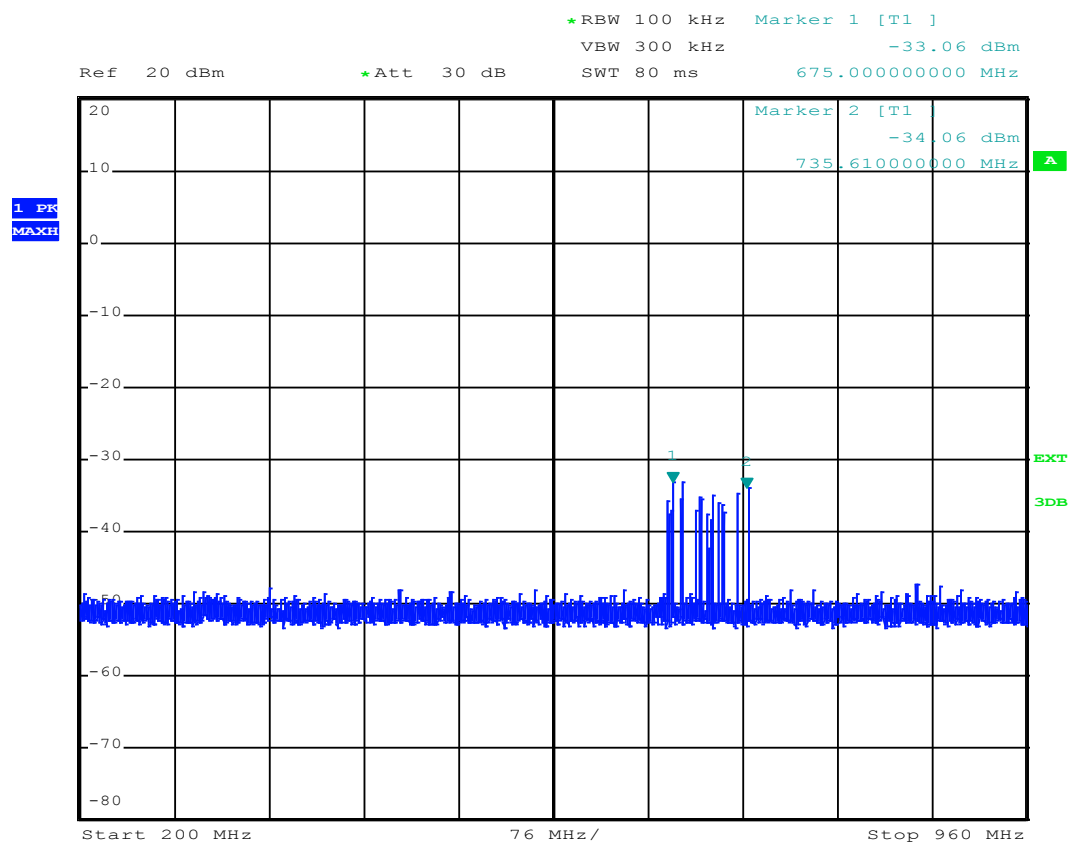
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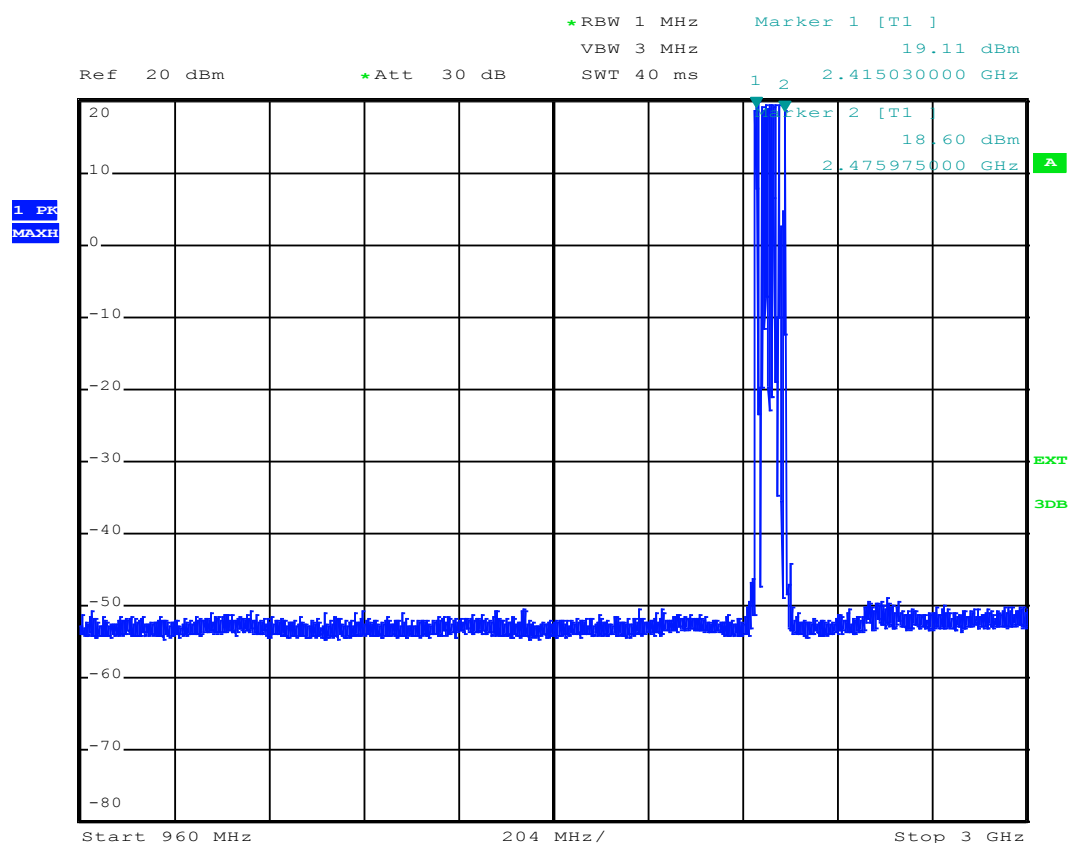
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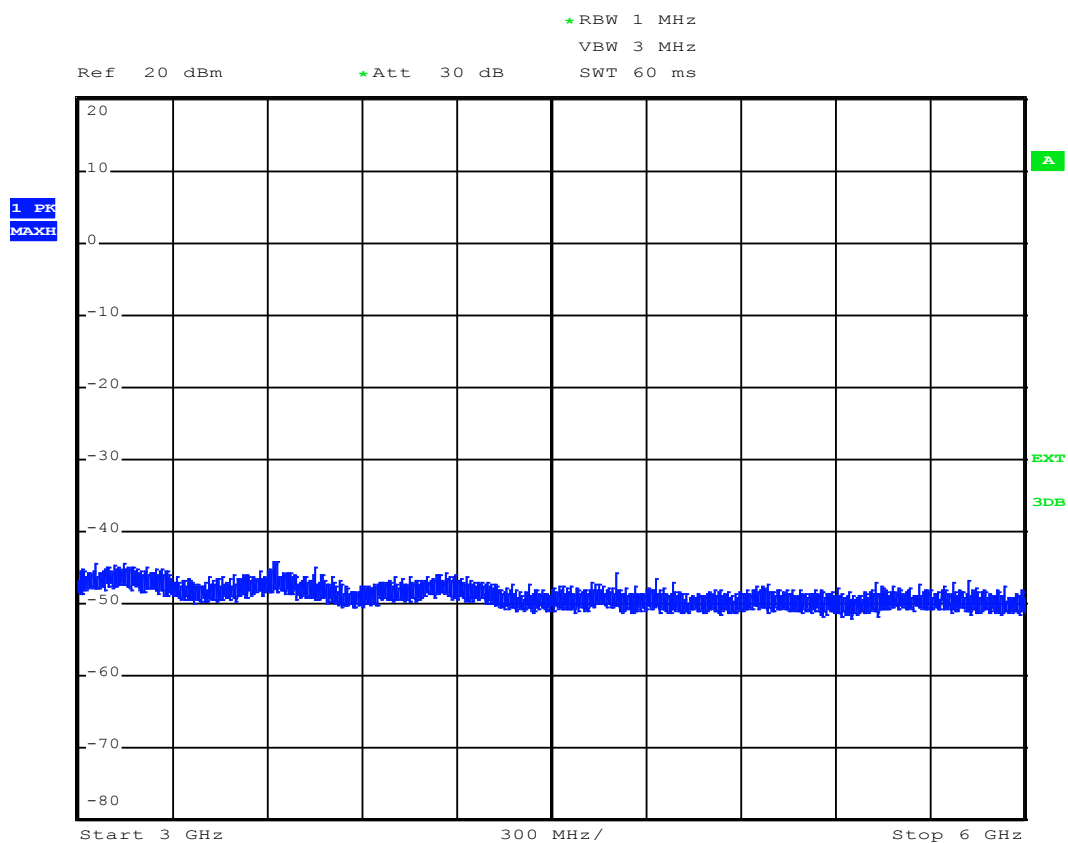
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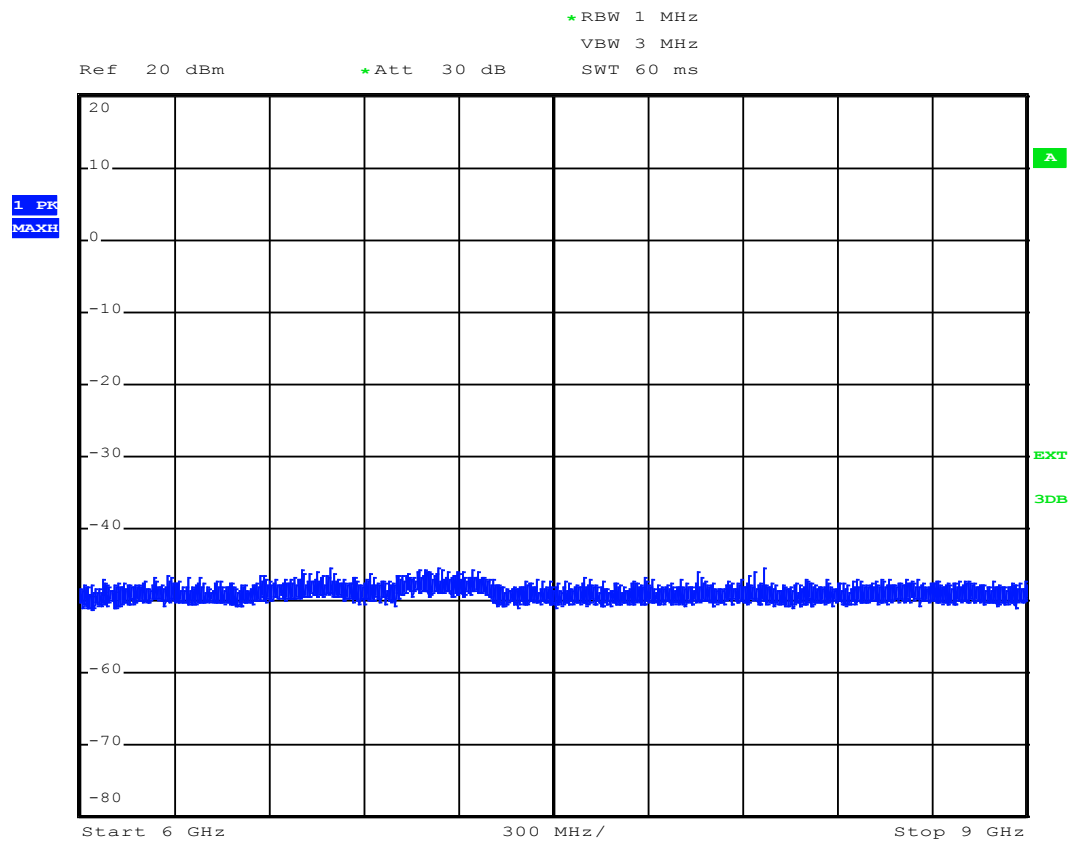
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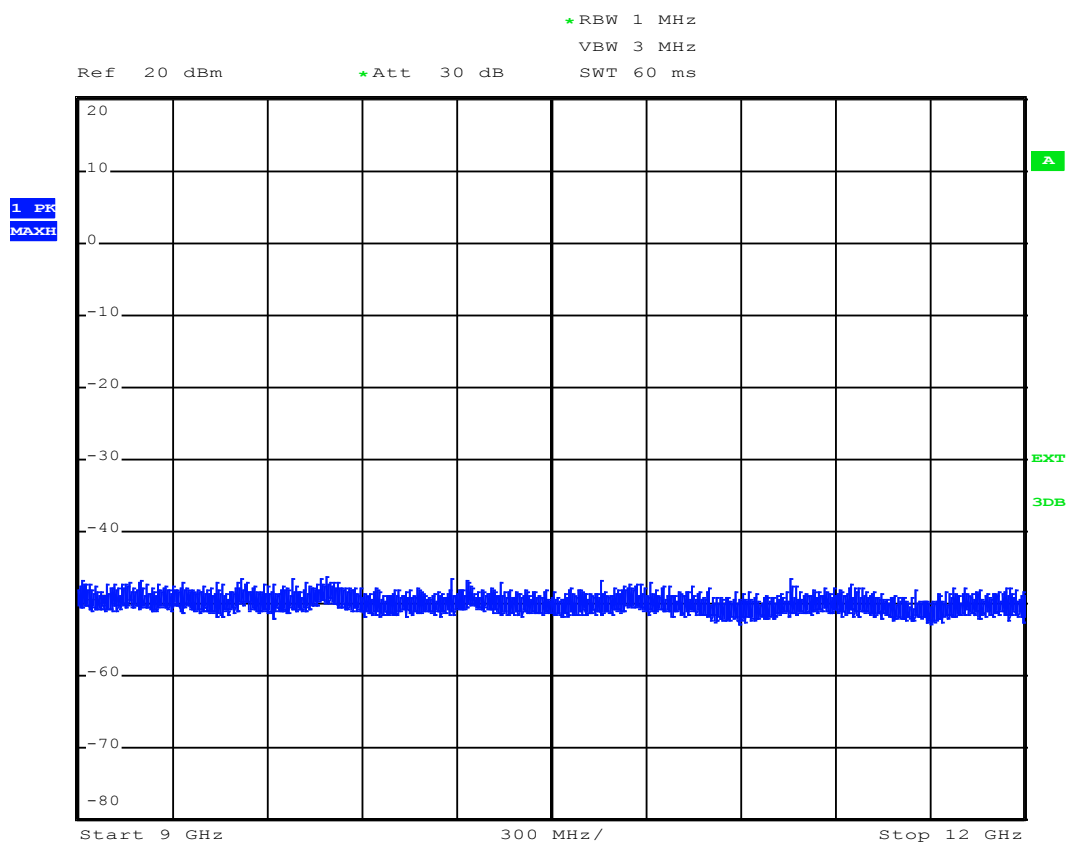
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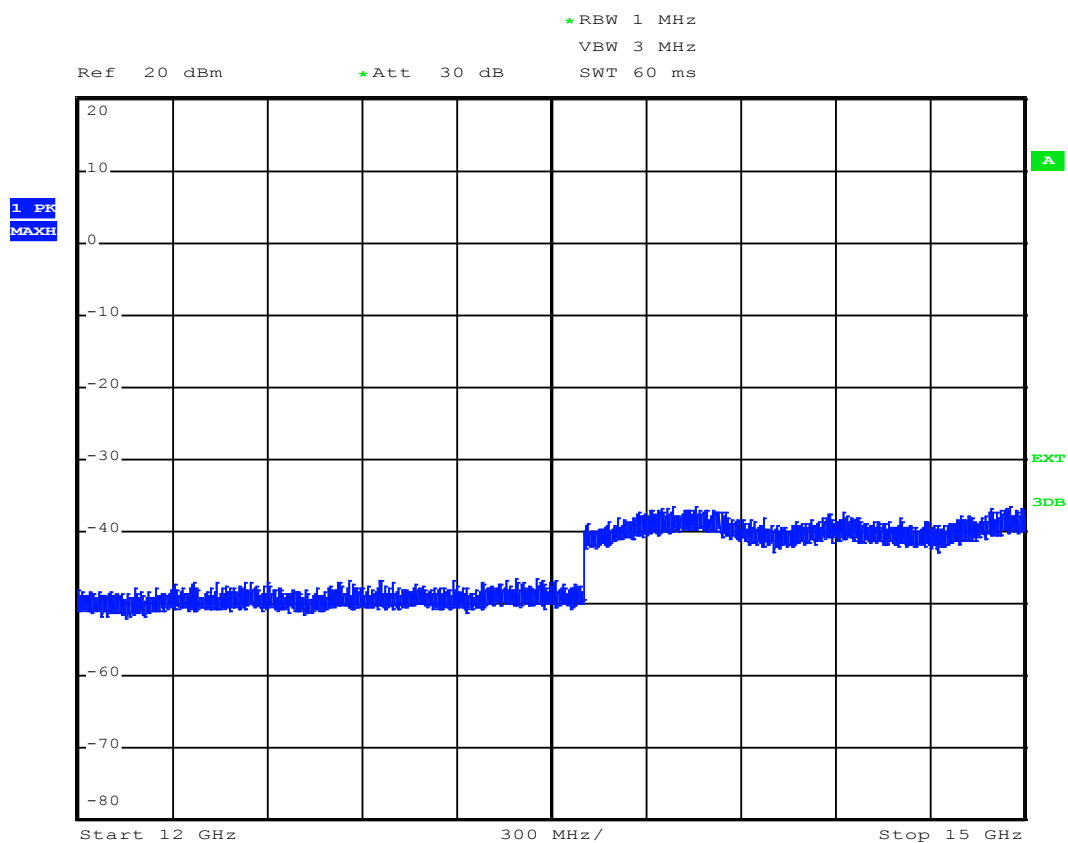
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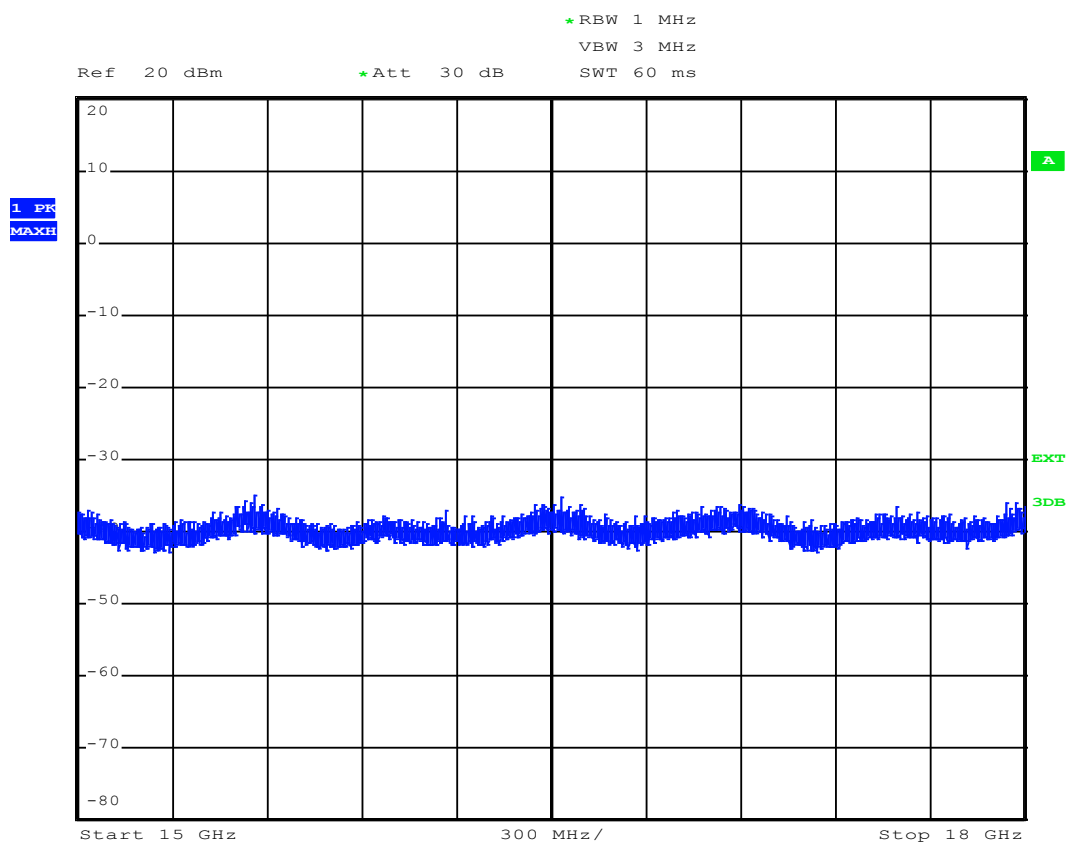
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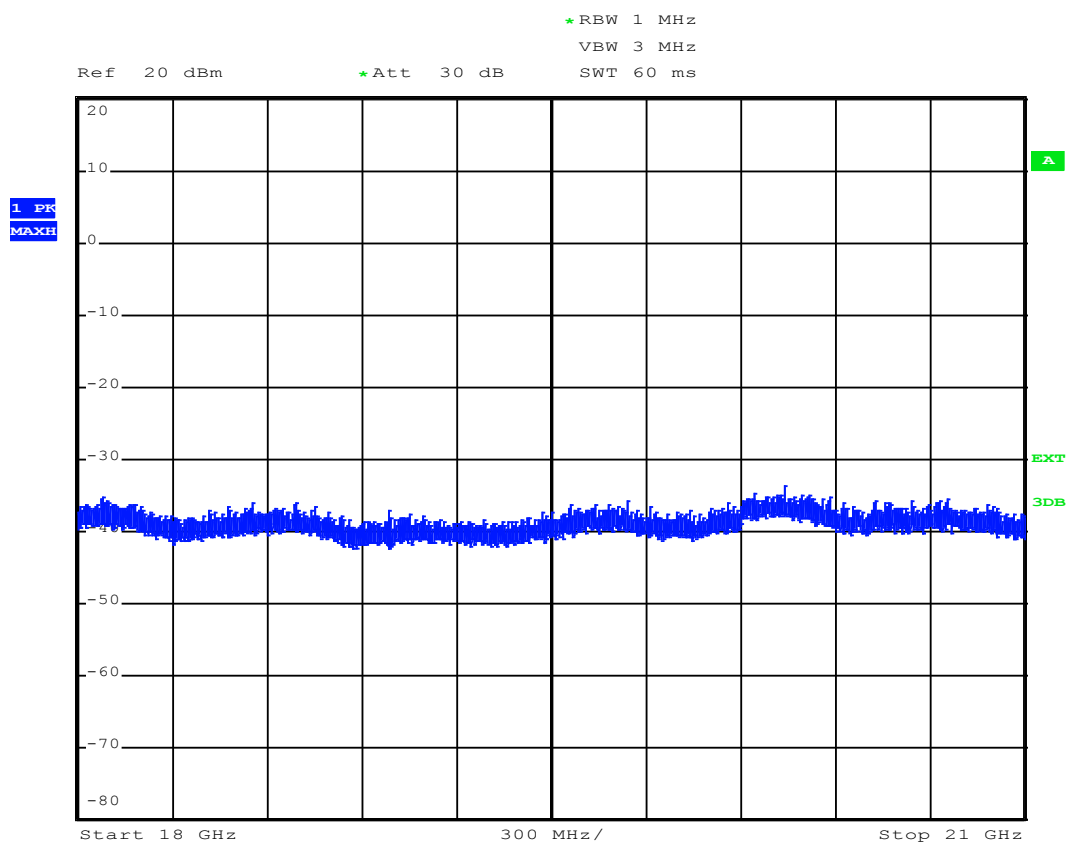
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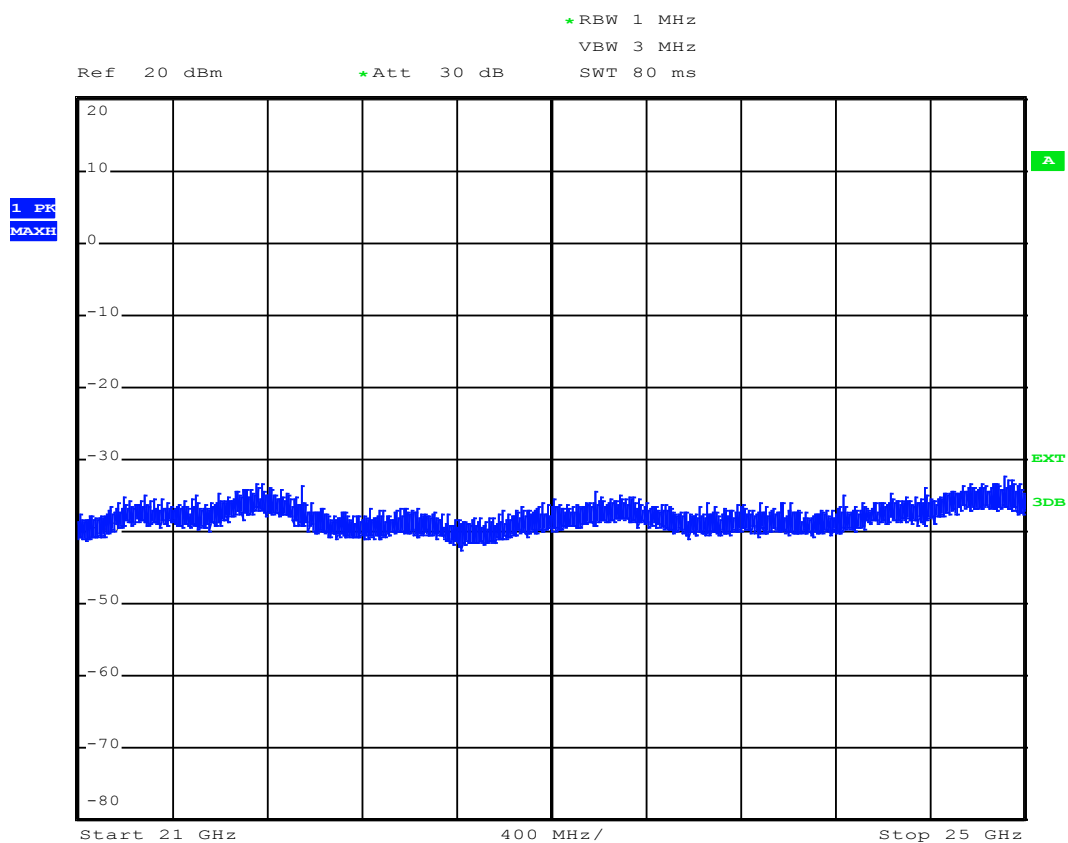
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