

RR051-15-101627-3-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Parrot minidrones HYDROFOIL DRONE

FCC ID: RKXHYDR

Company:
PARROT SA

DISTRIBUTION: Mr BEN YACOUB

(Company: PARROT SA)

Number of pages: 37 with 9 appendixes

Ed.	Date	Modified pages	Written by		Technical Verification and Quality Approval	
			Name	Visa	Name	Visa
0	24-JUN-2015	Creation	T. LEDRESSEUR	T.L	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: Parrot minidrones

Serial number (S/N): LFUZ5D0017AA for Bluetooth test
LFUZ5D00CAA for conducted test

Reference / model (P/N): HYDROFOIL

Software version: 1.0.0

HW version : HW01B

MANUFACTURER: PARROT SA

COMPANY SUBMITTING THE PRODUCT:

Company: PARROT SA

Address: 174 QUAI DE JEMMAPES
75010 PARIS
FRANCE

Responsible: Mr BEN YACOUB

Persons presents during the tests: Mr BEN YACOUB

DATE OF TEST: Between 08-JUN-2015 to 17-JUN-2015

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

TESTED BY: T .LEDRESSEUR

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1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: Parrot minidrones HYDROFOIL DRONE in accordance with normative reference.

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Residential use
Antenna type and gain:	internal antenna,
Operating frequency range:	from 2400 to 2483.5 MHz
Number of channels:	79
Channel spacing:	1 MHz
Modulation:	Bluetooth
Power source:	Rechargeable LiPo battery, 3.7Vdc

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

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 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

Equipment	Model	Type	Last verification	Next verification	Validity
0000	BAT-EMC	Software	/	/	/
1406	EMCO 6502	Loop antenna	27/01/2015	27/01/2017	27/03/2017
1922	Microwave DB C020180F-4B1	Low-noise amplifier	20/08/2014	20/08/2015	20/10/2015
1939	IMC WR42	Horn antenna	20/04/2012	20/04/2016	20/06/2016
1940	IMC WR42	Horn 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 BRM50702	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
8524	HP 8591EM	Test receiver	30/07/2013	30/07/2015	30/09/2015
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
8535	Emco 3115	Horn 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
8593	SIDT Cage 2	Full anechoic room	/	/	/
8641	SECRE ETP232	High-pass filter	14/04/2015	14/04/2017	14/06/2017
8671	HUGER	Meteo station	04/09/2014	04/09/2016	04/11/2016
8675	AOIP MN5102B	Multimeter	23/02/2015	23/02/2017	23/04/2017
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
8750	La Crosse Technology WS-9232	Meteo station	03/09/2014	03/09/2016	03/11/2016
8893	Emitech	Outside room	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9489	Absorber sheath current	Emitech	08/10/2014	08/10/2016	08/12/2016

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	See certification documents
FCC Part 15.21	INFORMATION TO USER				X	See certification documents

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:

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

The user notice shall include the following informations:

§15.21:

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

NAp: Not Applicable

NAs: Not Asked

USER NOTICE SHALL CONTAIN

The user notice shall include the following informations:

§ 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.

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		Note 2
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 3
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 4
	(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 5
	(a) (2) Digital modulation techniques			X		
	(b) Maximum peak output power	X				Note 6
	(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 7

NAp: Not Applicable

NAs: Not Asked

Note 1: Integral and dedicated antenna.

Note 2: The product can be connected to a computer for charging battery. When the product is connected to a computer it is not operational, the radio part is deactivated.

Note 3: See FCC part 15.247 (d).

Note 4: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

Note 5: 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 (1023.07 kHz; see appendix 5 and 7).

The frequency hopping system uses 79 channels (see appendix 9).

The timing by channel is 2.980968 ms (see appendix 8).

During 79 channels $\times 0.4 \text{ s} = 31.6 \text{ s}$, any channel is used 89 times (see appendix 8), then $89 \times 2.980968 \text{ ms} = 265.30 \text{ ms}$, 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 6: Conducted measurement is not possible (integral antenna), so we used the radiated method in open field.

RF EXPOSURE:

Note 7: In accordance with KDB 447498 D01 General RF Exposure Guidance v05r02

Maximum measured power = 96.94 dB μ V/m = 1.48 mW

($P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1$)

$PSD = EIRP / (4 \times \pi \times R^2) = 1.48 / (4 \times \pi \times (20 \text{ cm})^2) = 0.00029444 \text{ mW/cm}^2$ (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.

7. 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): 22
Relative humidity (%): 38

Power source: battery fully charged

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

Sample N° 1:

<u>FUNDAMENTAL FREQUENCY (MHZ)</u>	<u>FIELD STRENGTH LEVEL OF FUNDAMENTAL (DBμV/M)</u>	<u>DETECTOR (PEAK OR AVERAGE)</u>	<u>FREQUENCY OF MAXIMUM BAND- EDGES EMISSION (MHZ)</u>	<u>DELTA MARKER (DB)*</u>	<u>CALCULATED MAX OUT-OF- BAND EMISSION LEVEL (DBμV/M)</u>	<u>LIMIT (DBμV/M)</u>	<u>MARGIN (DB)</u>
2402	93.8	PEAK	2399.37	34.73	59.07	73.8	14.73
2480	96.3	PEAK	2483.58	40.9	55.4	74	18.6
2480	96.3	AVERAGE	2483.535	47.89	48.41	54	5.59

* Marker-Delta method

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

Test conclusion:

RESPECTED STANDARD

8. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Test set up:

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

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

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

Zero degree azimuth corresponds 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 10 MHz and video bandwidth at 10 MHz.

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

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): 21.4
Relative humidity (%): 38

Power source: battery fully charged

Sample N° 1 Low Channel

	Electro-magnetic field (dBμV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage:	96.08	0.00122	1

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

Position of equipment: See photos in appendix 2 (azimuth: 93 degrees)

Sample N° 1 Central Channel

	Electro-magnetic field (dBμV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage:	96.94	0.00148	1

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

Position of equipment: See photos in appendix 2 (azimuth: 93 degrees)

Sample N° 1 High Channel

	Electro-magnetic field (dBμV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage:	96.86	0.00146	1

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

Position of equipment: See photos in appendix 2 (azimuth: 93 degrees)

* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1$

Test conclusion:

RESPECTED STANDARD

9. INTENTIONAL RADIATOR

Standard: FCC Part 15

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

Test set up:

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

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, 1.5m 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 25GHz (10th harmonic of the highest fundamental frequency)

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: 3 meters

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.

Results:

Ambient temperature (°C): 22.5
Relative humidity (%): 38

Power source: battery fully charged

Sample N° 1 Low Channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4804 ⁽¹⁾	P	1000	V	51.934	74	22.1
4804 ⁽¹⁾	Av	1000	V	29.734	54	24.0
7206	P	100	V	43.19	76.94	33.75

Sample N° 1 Central Channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4880 ⁽¹⁾	P	1000	V	54.765	74	19.235
4880 ⁽¹⁾	Av	1000	V	31.065	54	22.935
7320 ⁽¹⁾	P	1000	V	49.19	74	24.81
7320 ⁽¹⁾	Av	1000	V	31.99	54	22.01

Sample N° 1 High Channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4960 ⁽¹⁾	P	1000	V	54.03	74	19.97
4960 ⁽¹⁾	Av	1000	V	31.63	54	22.37
7440 ⁽¹⁾	P	1000	V	49.09	74	24.91
7440 ⁽¹⁾	Av	1000	V	33.89	54	20.11

⁽¹⁾ restricted bands of operation in 15.205

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 96.94 dB μ V/m on central channel.
So the applicable limit is 76.94 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 appendixes to be forwarded □□□

APPENDIX 1: Photos of the equipment under test

CONFIDENTIAL

APPENDIX 2: Test set up

CONFIDENTIAL

APPENDIX 3: Test equipment list

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
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750

Maximum peak output power

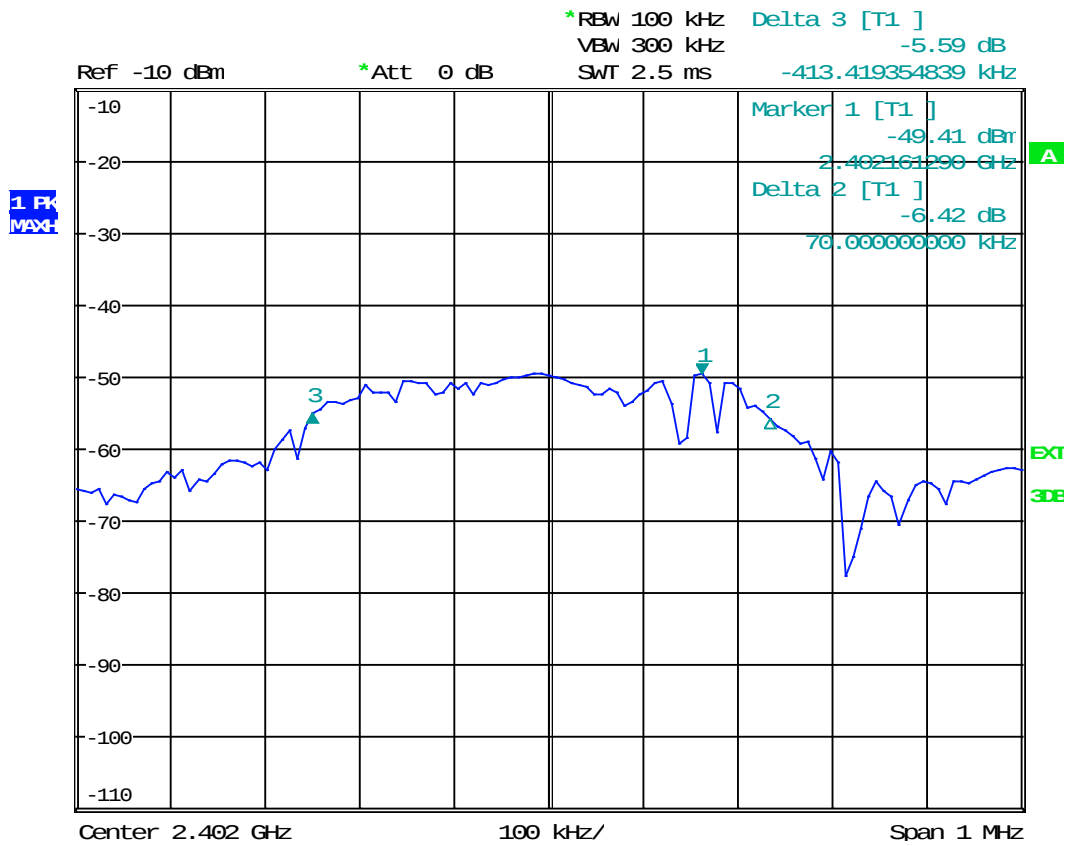
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	Electrometrics	8535
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC	0000

Intentional radiator

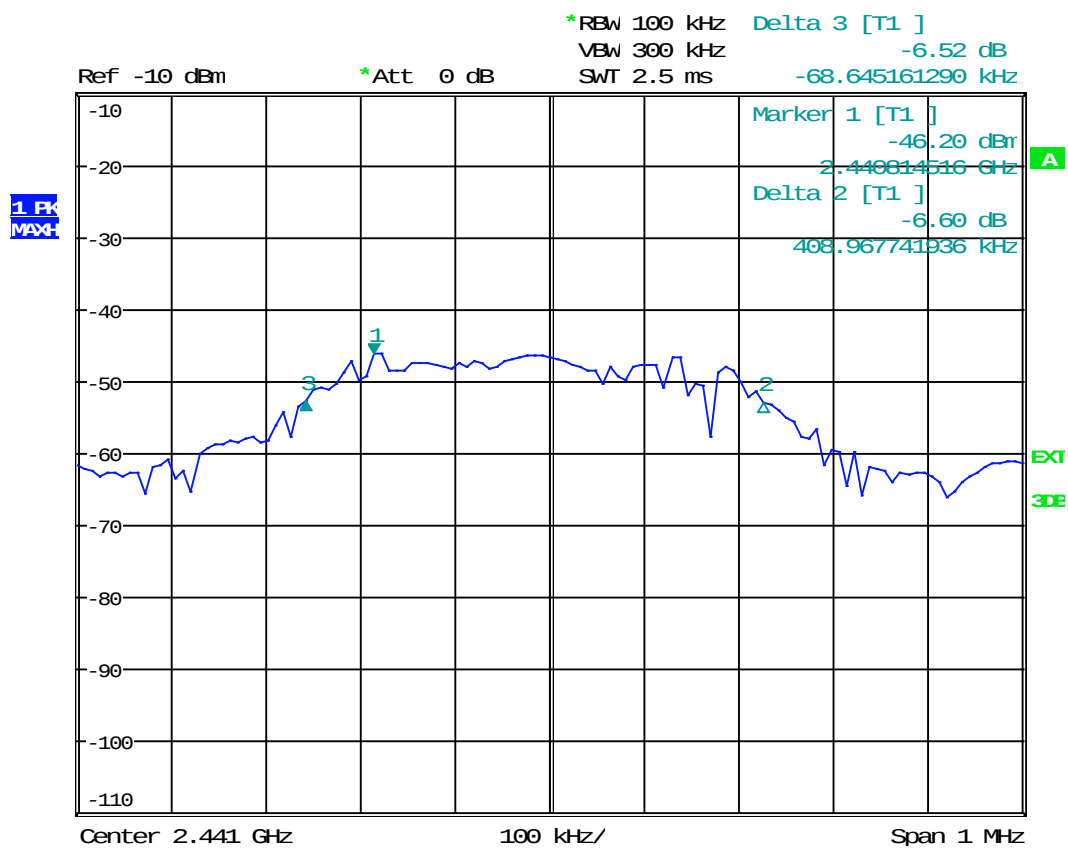
TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna EMCO 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
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
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC	0000

APPENDIX 4: 6 dB bandwidth

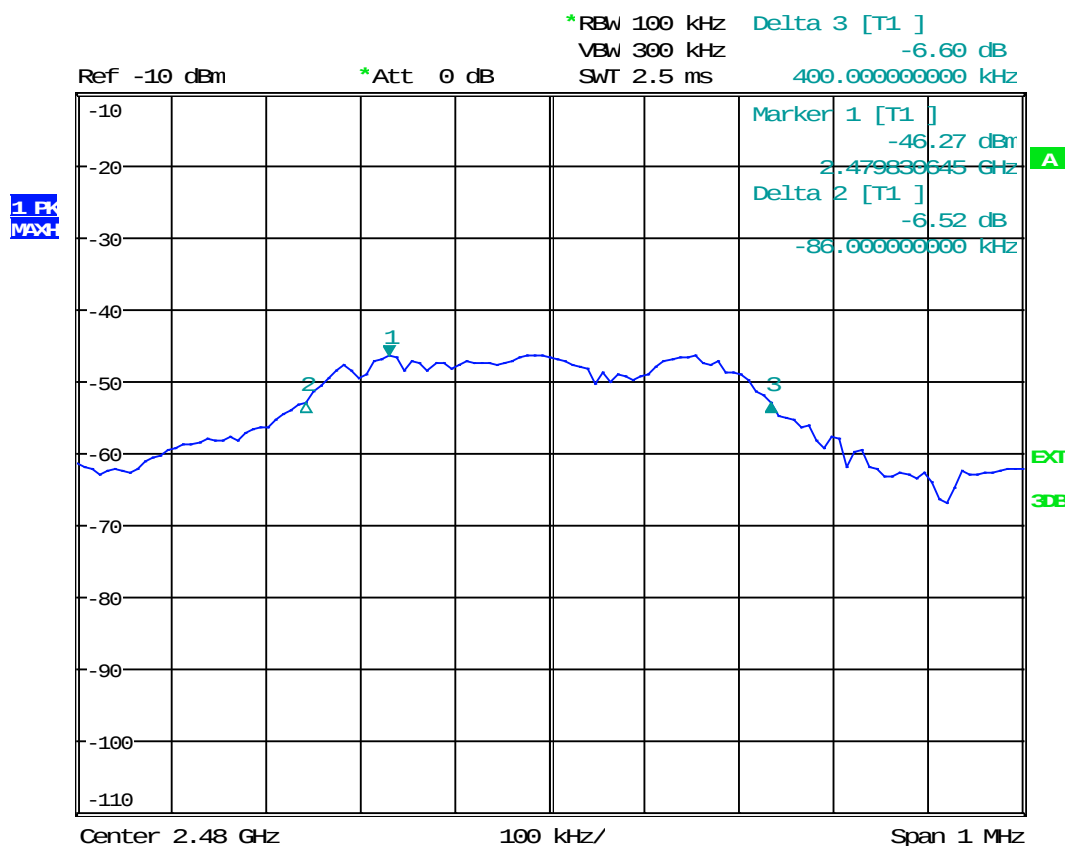
Low channel



Central channel

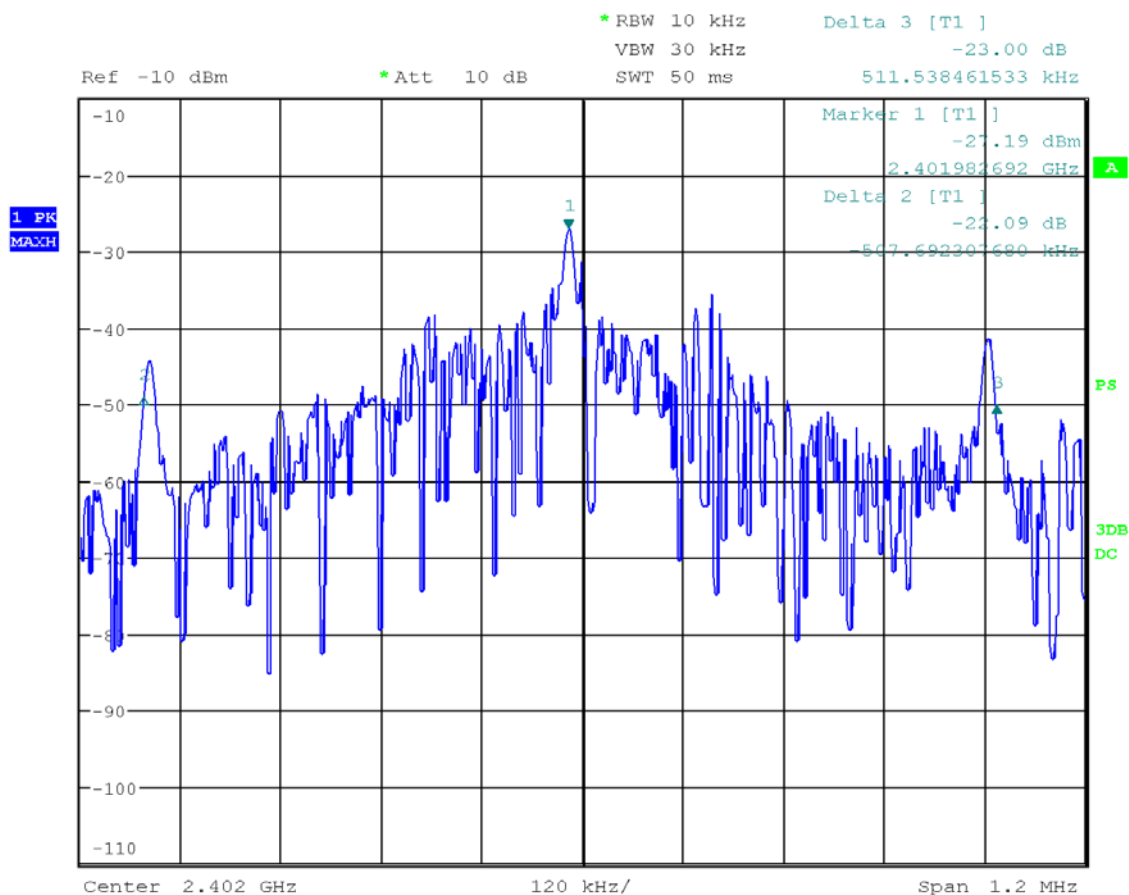


High channel



APPENDIX 5: 20 dB bandwidth

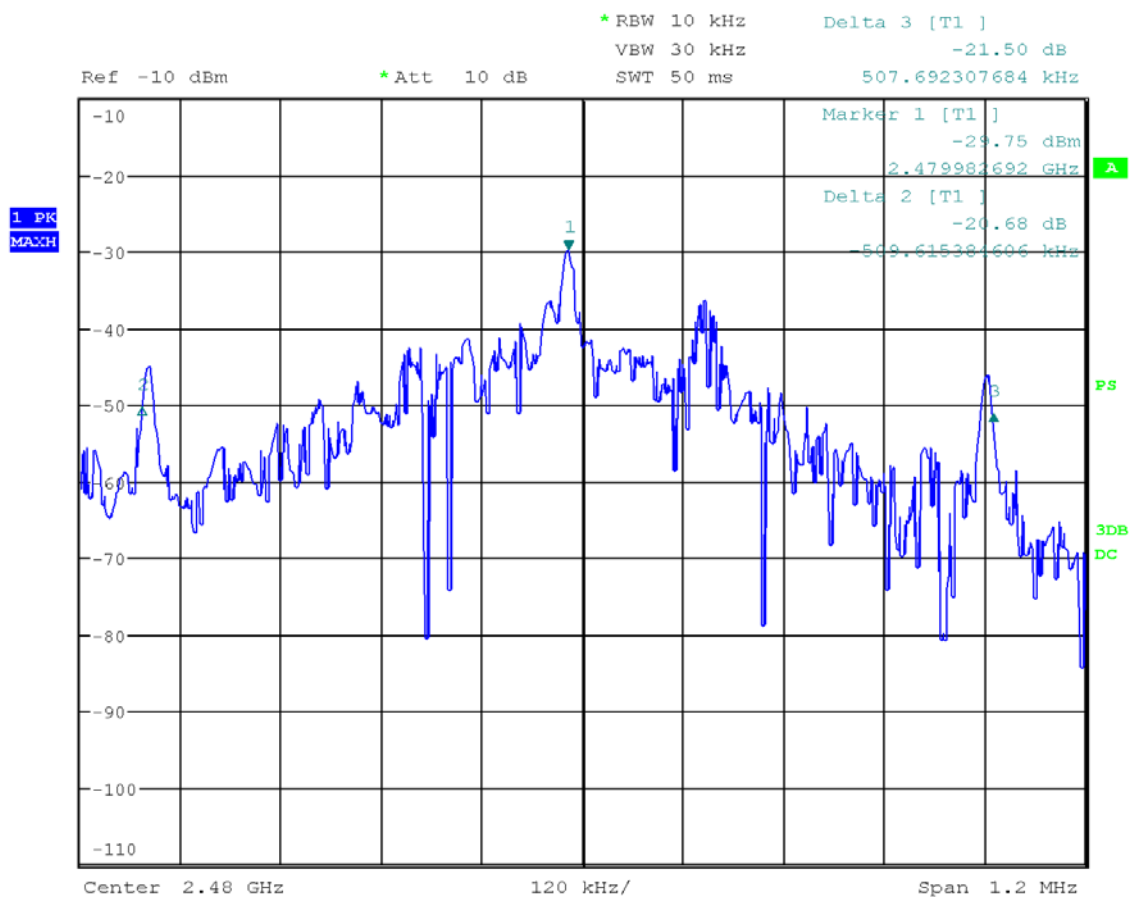
Low channel



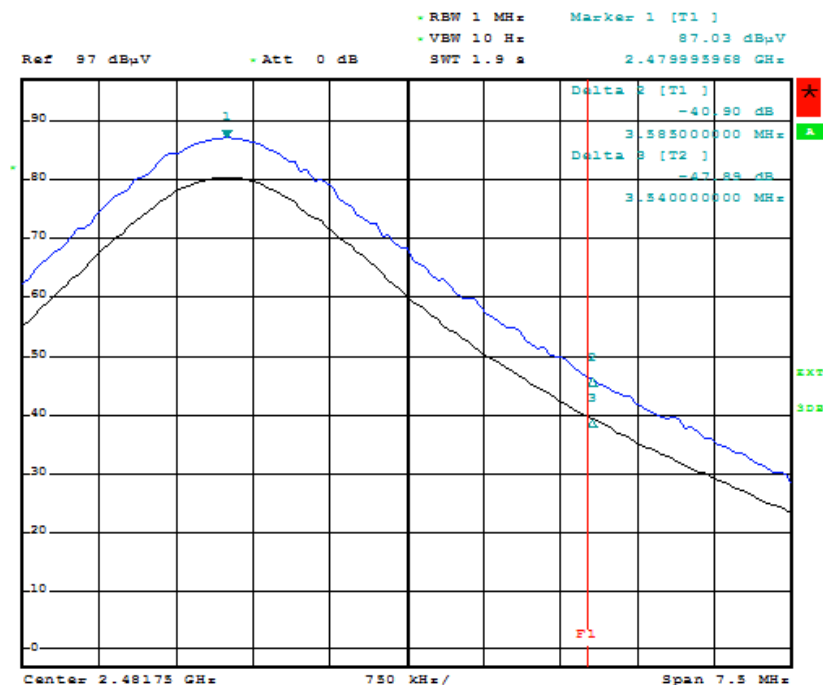
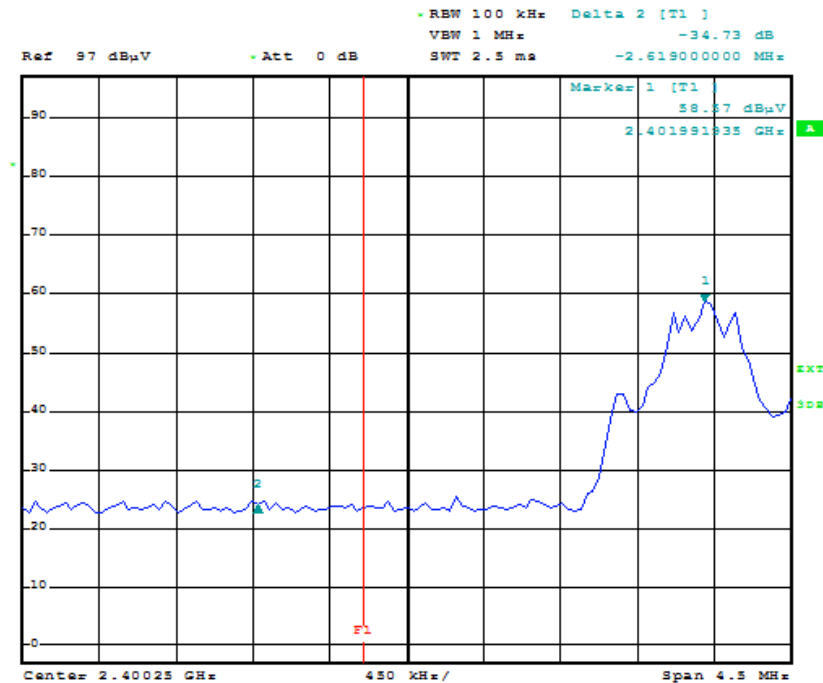
Central channel



High channel



APPENDIX 6: Band edge

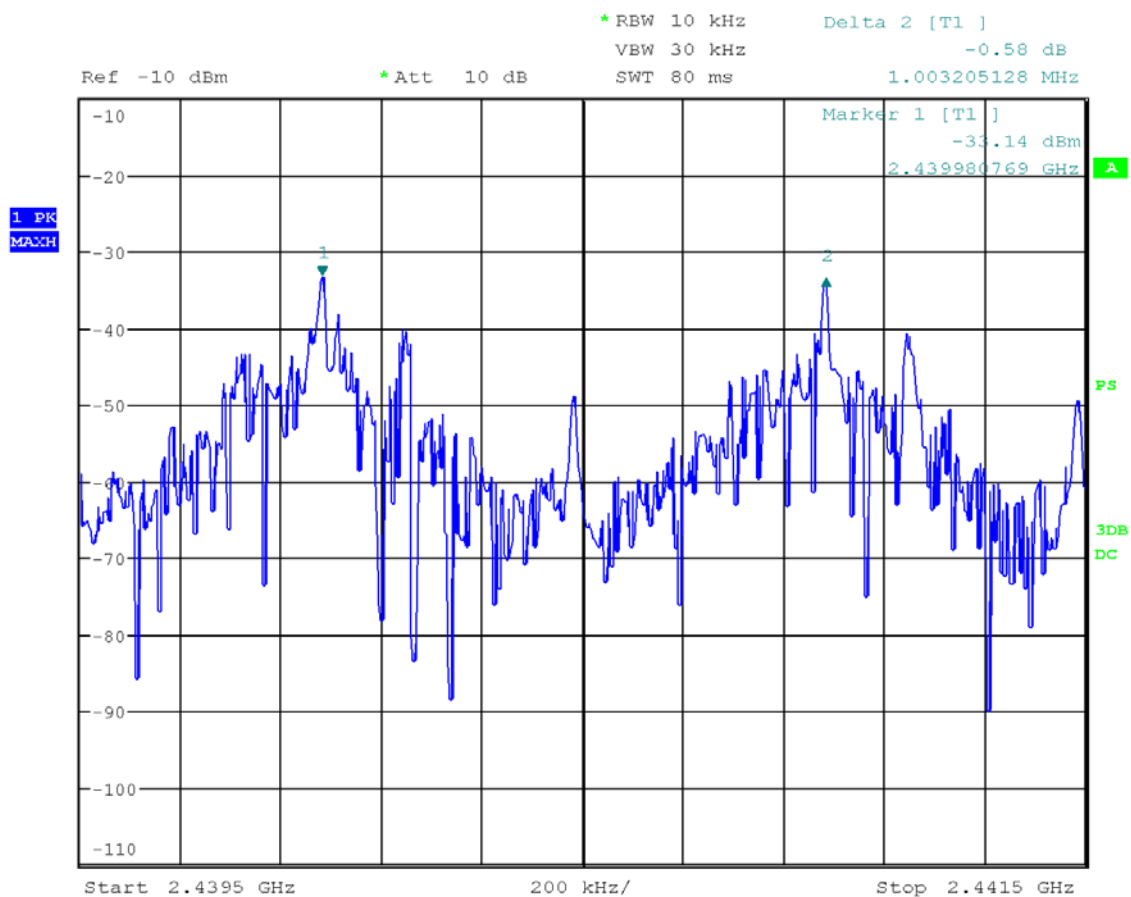


APPENDIX 7: Channel spacing

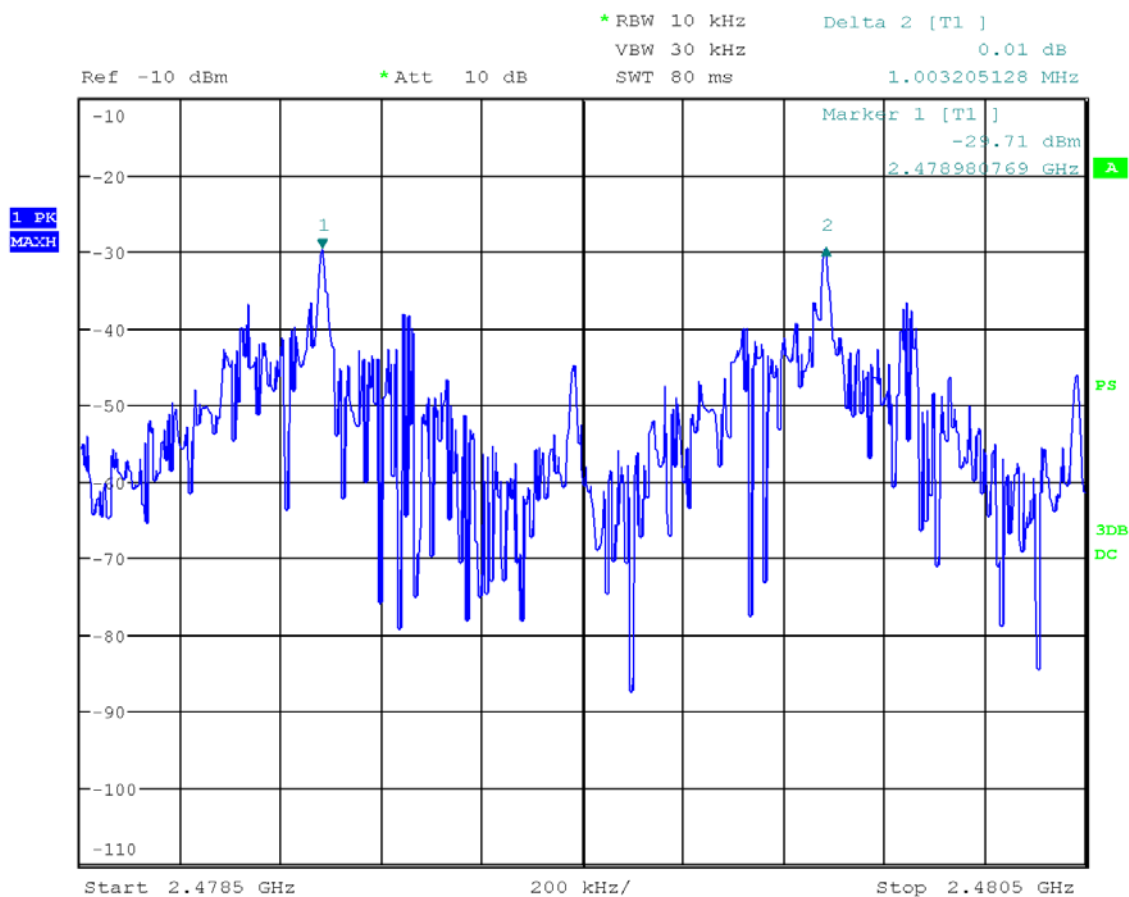
Low channel



Central channel

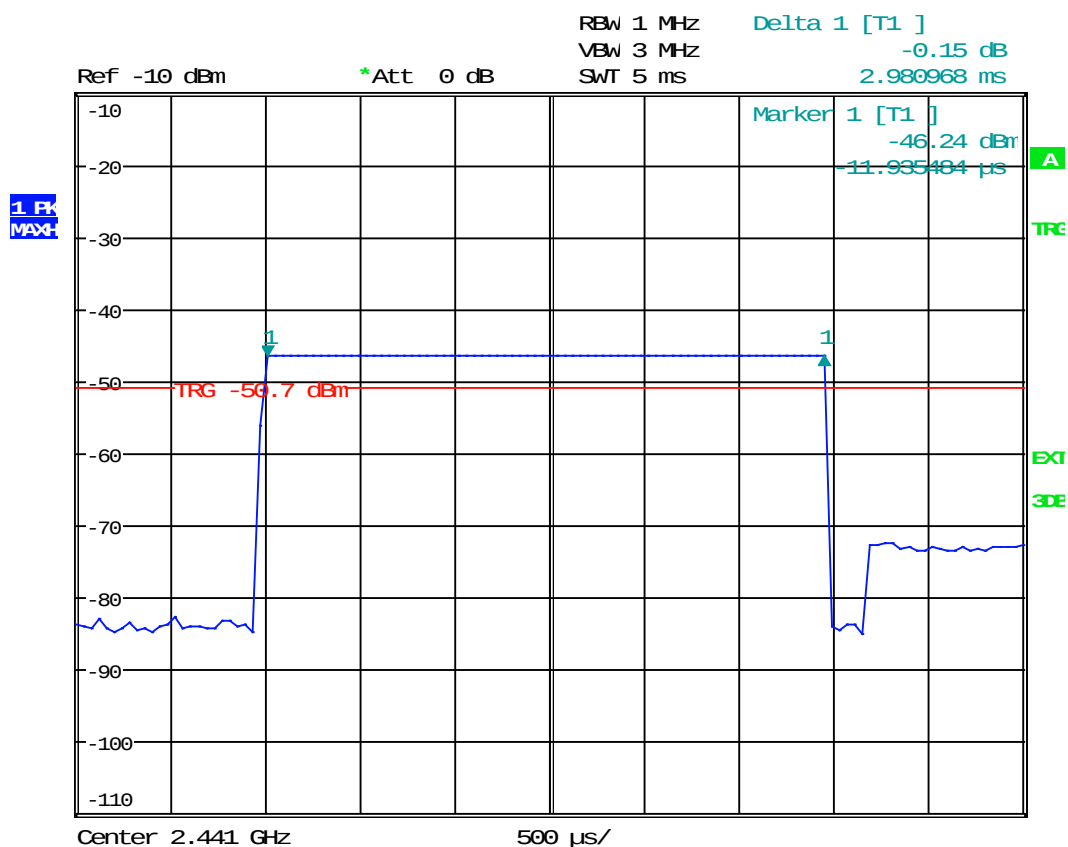


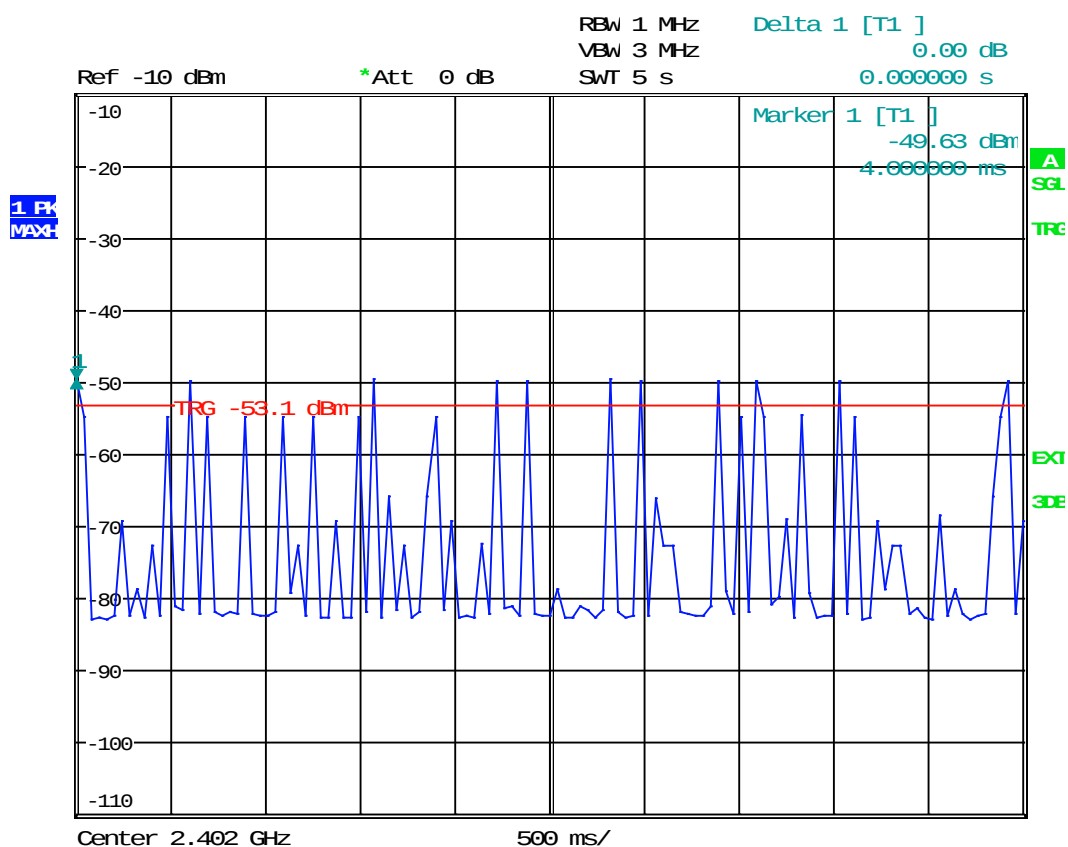
High channel



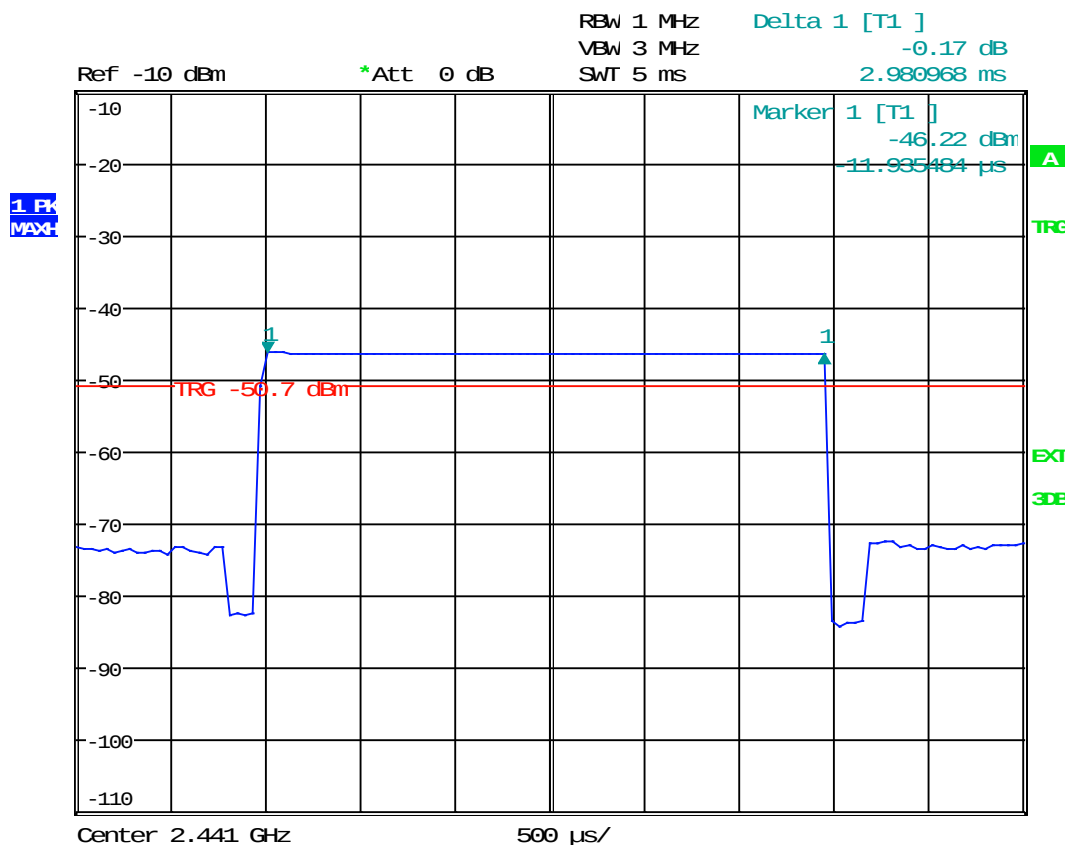
APPENDIX 8: Time of occupancy on any frequency

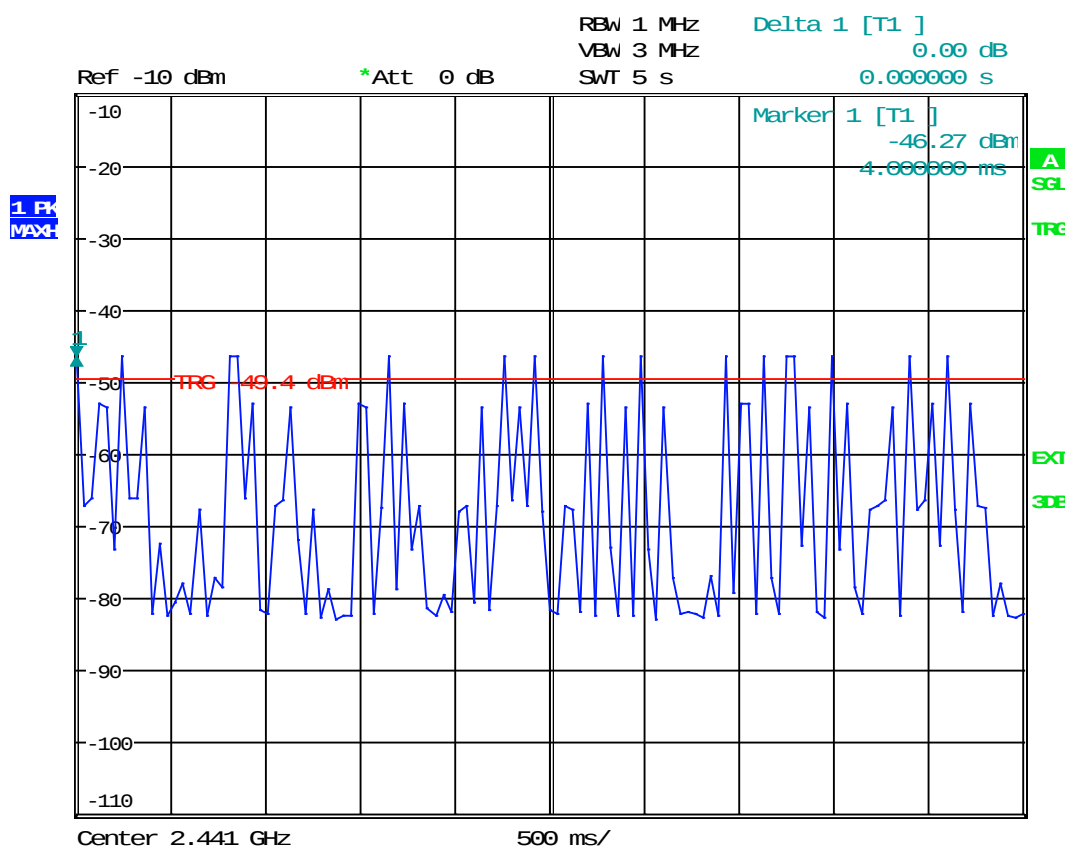
Low channel



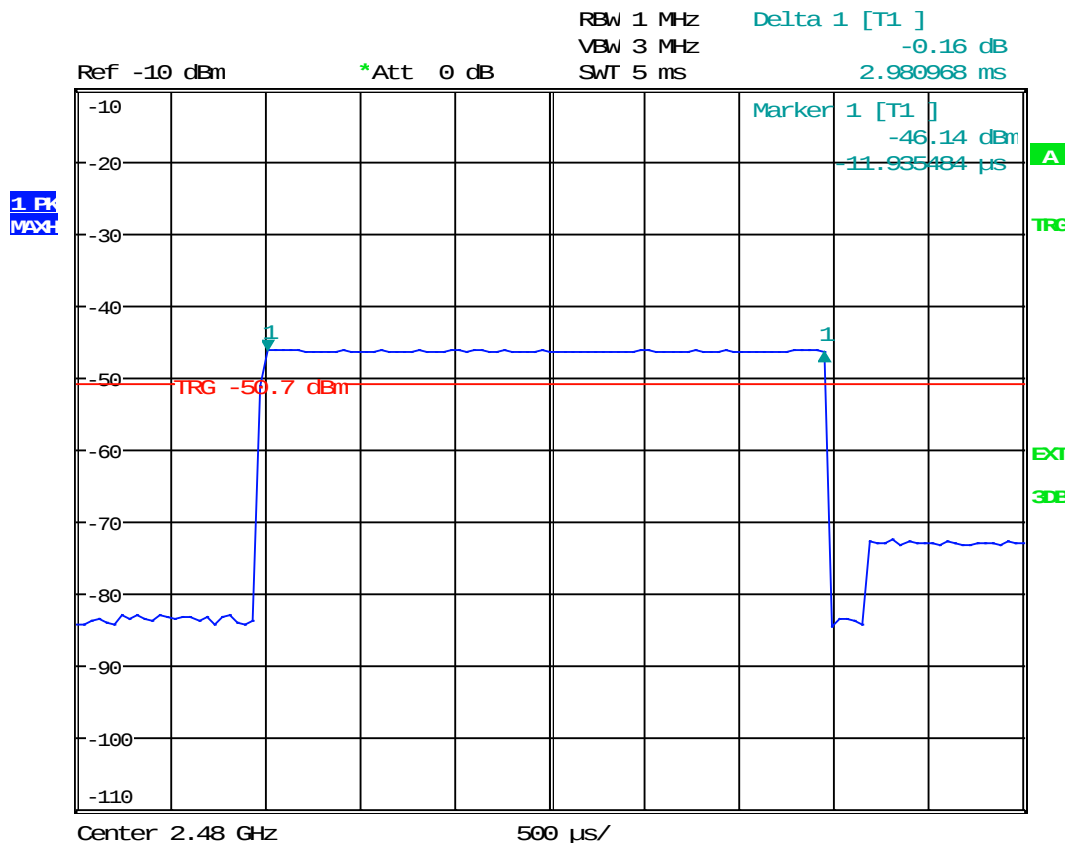


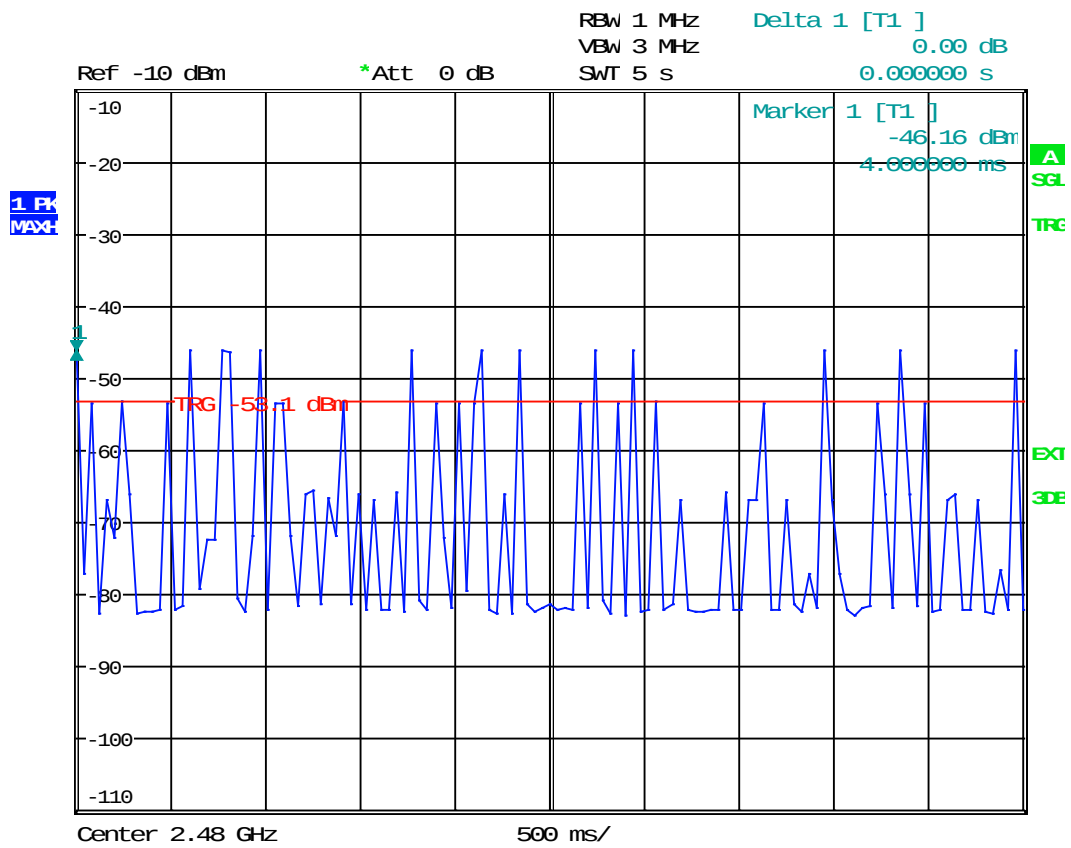
Central channel





High channel





APPENDIX 9: Number of hopping channels

Number of Hopping Frequencies	Limit hopping sequence
79	15 or $N=15/(\text{min. HFS})$

HFS : Hopping Frequency Sequence in MHz (often 1MHz)

