

RR051-16-102195-3-A Ed. 1

This report cancels and replaces the test report N° RR051-16-102195-3-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Parrot MAMBO

FCC ID:
2AG6IDELOS3

Company:
PARROT DRONES SAS

DISTRIBUTION: Mr BEN YACOUB

(Company: PARROT DRONES SAS)

Number of pages: 61 with 10 annexes

Ed.	Date	Modified pages	Written by		Technical Verification and Quality Approval	
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1	22-JULY-2016	1 and 2	S. LOUIS	SL	T. LEDRESSEUR	

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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 MAMBO

Serial number (S/N): Sample 1:PI040408D26E000600
Sample 2:PI040408D26E000677

Reference / model (P/N): MAMBO

Hardware version: Sample 1: HW02
Sample 2: HW02

Software version: Sample 1: 1.0
Sample 2: 0.2.2

Accessories tested: GUN: PI020664D26E000587
CLAW: PI020665D26E000382
LIGHT: PI020666D26E000181

MANUFACTURER: PARROT DRONES SAS

COMPANY SUBMITTING THE PRODUCT:

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Responsible: Mr BEN YACOUB

DATES OF TEST: From 9-JUNE-2016 to 16-JUNE-2016

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
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FCC Accredited under US-EU MRA Designation Number: FR0009
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TESTED BY: S. LOUIS

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1. INTRODUCTION

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

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Residential use
Antenna type and gain:	Wire antenna; 1.84dBi (maximal gain declared by the applicant)
Operating frequency range:	From 2402MHz to 2480MHz
Frequency tested:	2402 MHz (low channel), 2440 MHz (central channel) and 2480 MHz (high channel)
Number of channels:	79
Channel spacing:	1 MHz
Frequency generation:	Bluetooth (FHSS)
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 (2016) Radio Frequency Devices

ANSI C63.4 2014
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 2013
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

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

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
1939	IMC WR42	Antenna	16/05/2016	16/05/2019	16/07/2019
1940	IMC WR42	Antenna	16/05/2016	16/05/2019	16/07/2019
3036	ALC Microwave ALN02-0102	Low-noise amplifier	06/08/2015	06/08/2016	06/10/2016
4087	Filtek LP03/1000-7GH	Low Pass Filter	05/04/2016	05/04/2018	05/06/2018
4088	R&S FSP40	Spectrum Analyzer	29/10/2015	29/10/2017	29/12/2017
7299	Microtronics BRM50702	Reject band filter	04/11/2015	04/11/2017	04/01/2018
8508	California instruments 1251RP	Power source	12/10/2015	12/10/2016	12/12/2016
8511	HP 8447D	Low noise preamplifier	07/10/2015	07/10/2016	07/12/2016
8526	Schwarzbeck VHBB 9124	Biconical antenna	12/06/2015	12/06/2018	12/08/2018
8528	Schwarzbeck VHA 9103	Biconical antenna	15/03/2016	15/03/2019	15/05/2019
8535	EMCO 3115	Antenna	29/10/2012	29/10/2016	29/12/2016
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	12/06/2015	12/06/2018	12/08/2018
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High pass Filter	05/08/2014	05/08/2016	05/10/2016
8671	HUGER	Meteo station	04/09/2014	04/09/2016	04/11/2016
8676	ISOTECH IDM106N	Multimeter	21/05/2015	21/05/2017	21/07/2017
8707	R&S ESI7	Test receiver	11/12/2014	11/12/2016	11/02/2017
8719	Thurbly Thandar Instruments 1600	LISN	06/04/2016	06/04/2018	06/06/2018
8732	Emitech	OATS	18/02/2015	18/02/2018	18/04/2018
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	15/03/2016	15/03/2019	15/05/2019
8864	Champ libre Juigné. V3.4	Software	/	/	/
8893	Emitech	Outside room Hors cage	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9403	R&S ESU8	Spectrum Analyzer	08/06/2014	08/06/2016	08/08/2016
10318	Fluke 177	Multimeter	24/08/2015	24/08/2017	24/10/2017
10651	Absorber sheath current	Emitech	21/04/2016	21/04/2018	21/06/2018
10739	Lucix S005180M3201	Low-noise amplifier	20/01/2016	20/01/2017	20/03/2017
11370	R&S CBT32	Bluetooth tester	28/05/2015	28/05/2017	28/07/2017
/	GPIB SHOT	Software	/	/	/

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

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
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

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					
	<i>(a) Alternative to general radiated emission limits</i>	X				
	<i>(b) Unwanted emissions outside of §15.247 frequency bands</i>	X				Note 4
	<i>(c) 20 dB bandwidth and band-edge compliance</i>	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
	<i>(a) (1) Hopping systems</i>	X				Note 5
	<i>(a) (2) Digital modulation techniques</i>			X		
	<i>(b) Maximum peak output power</i>	X				Note 6
	<i>(c) Operation with directional antenna gains > 6 dBi</i>			X		
	<i>(d) Intentional radiator</i>	X				
	<i>(e) Peak power spectral density</i>	X				
	<i>(f) Hybrid system</i>			X		
	<i>(g) Frequency hopping requirements</i>			X		
	<i>(h) Frequency hopping intelligence</i>			X		
	<i>(i) RF exposure compliance</i>	X				

NAp: Not Applicable

NAs: Not Asked

Note 1: Integral antenna.

Note 2: The product can be connected to a computer or AC/DC adapter for charging battery. When the product is connected, the radio part is not operational.

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 two-thirds of the 20 dB bandwidth of the hopping channel (see appendix 5 and 8).

The frequency hopping system uses 79 channels (see appendix 10).

The timing by channel is 373.75 μ s (see appendix 9).

During 79 channels \times 0.4 s = 31.6 s, any channel is used 325 times (see appendix 9), then 325 \times 373.75 μ s = 121.47 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.

Number of channels	Observation period (0.4s * Nbr of channel) (s)	Maximal Duration of each burst (μ s)	Number of burst repetition during observation period	average time of occupancy on any channel (ms)	Limits (s)
79	31.6	373.75	325	0.121	0.4

Note 6: Conducted measurement is not possible (integral antenna), so we used the radiated method in open field.

RF EXPOSURE:

Maximum measured power = 0.85mW at 2440MHz with claw accessory.

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

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

$PSD = EIRP / (4 \times \pi \times R^2) = 0.85 / (4 \times \pi \times (20 \text{ cm})^2) = 0.17 \times 10^{-3} \text{ mW/cm}^2$ (limit = 1mW/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. 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 a 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 / Quasi-peak / Average

Bandwidth: 10 kHz / 9 kHz

Equipment under test operating condition:

The equipment is blocked in charging mode via an AC / DC adapter supplied with 120Vac – 60Hz.

Results:

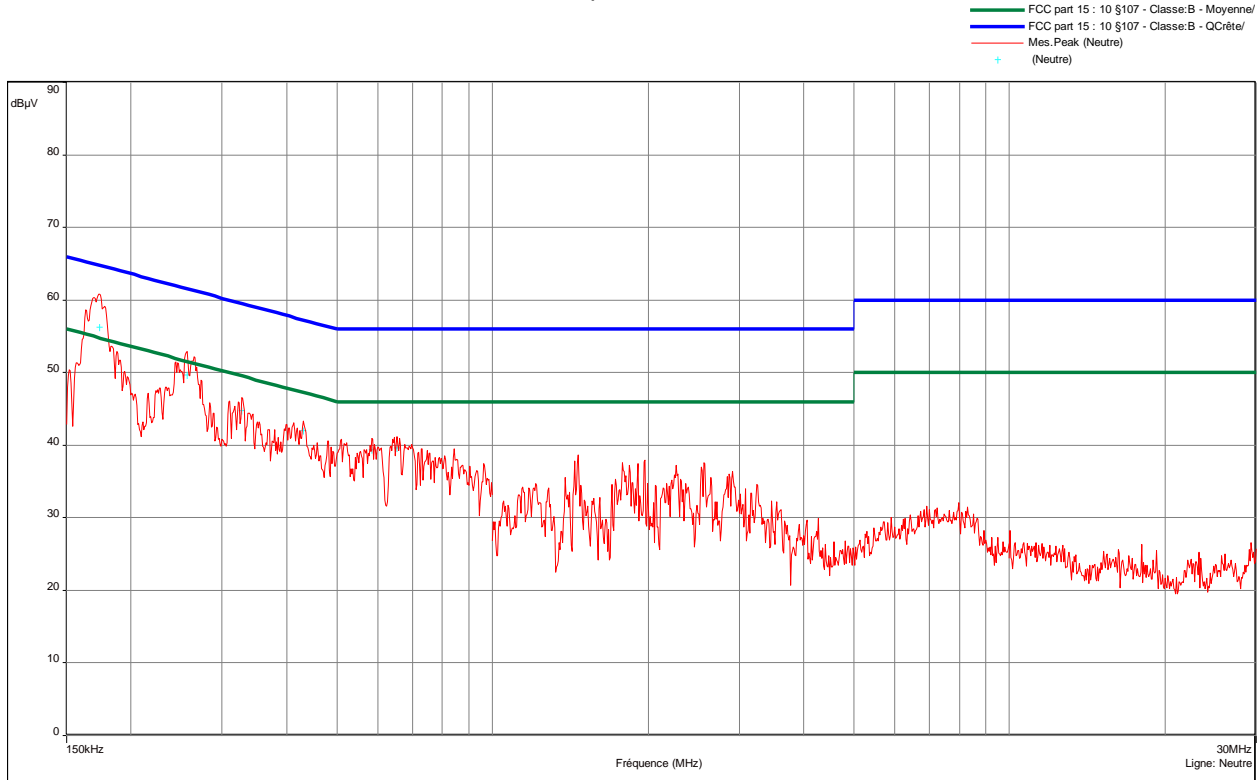
Ambient temperature (°C):	22
Relative humidity (%):	58

Sample N° 1: with GUN accessory

Measurement on the mains power supply:

The measurement is first realized with Peak detector.

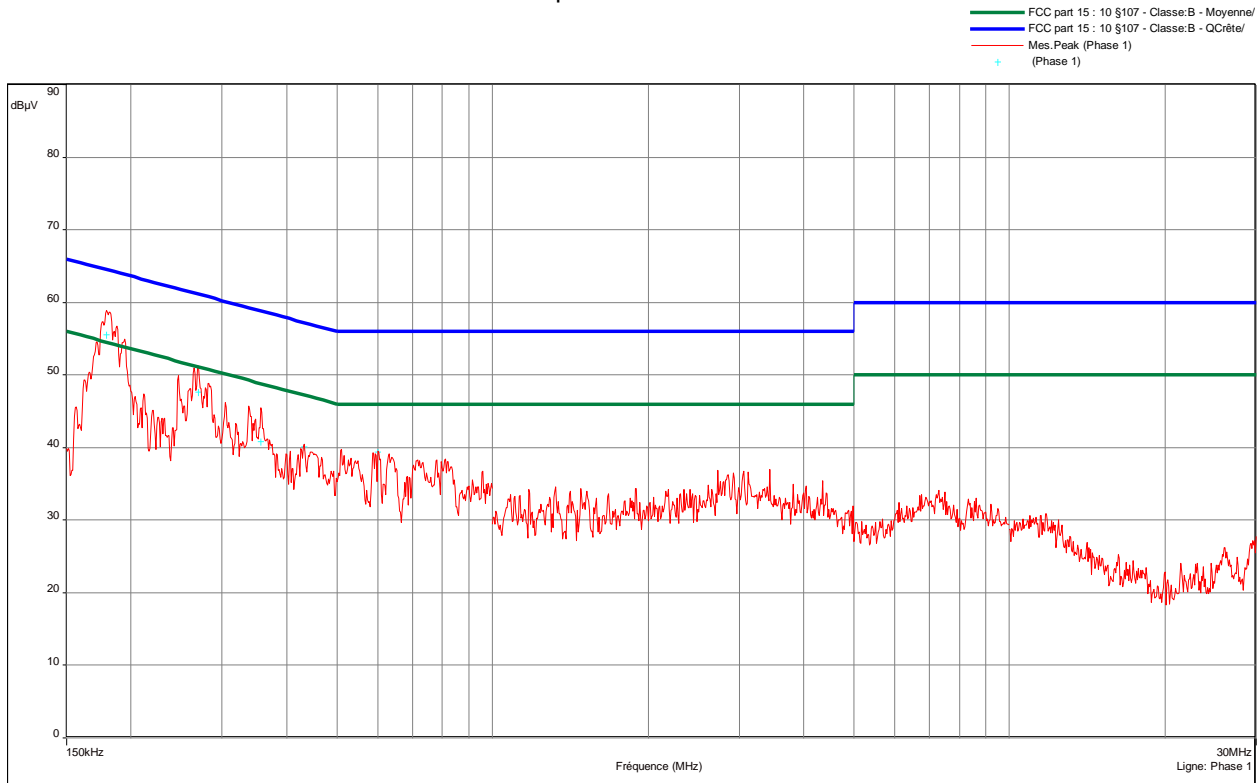
Curve N° 1: measurement on the Neutral with peak detector



The frequencies which are not 6 dB under the average limit are then analyzed with Quasi-peak detector and Average detector.

F (MHz)	Pk (dBµV)	Qp (dBµV)	lim QP (dBµV)	margin QP (dB)	Av (dBµV)	lim Av (dBµV)	Margin Av (dB)
0.1738	56.3	50.01	64.777	14.767	36.92	54.777	17.857
0.25625	49.72	42.53	61.552	19.022	28.73	51.552	22.822
0.32782	44.82	36.5	59.506	23.006	21.58	49.506	27.926
0.430755	42.04	34.86	57.238	22.378	21.9	47.238	25.338
0.5852	39.36	33.94	56	22.06	18.75	46	27.25
0.65337	39.65	33.89	56	22.11	16.37	46	29.63

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



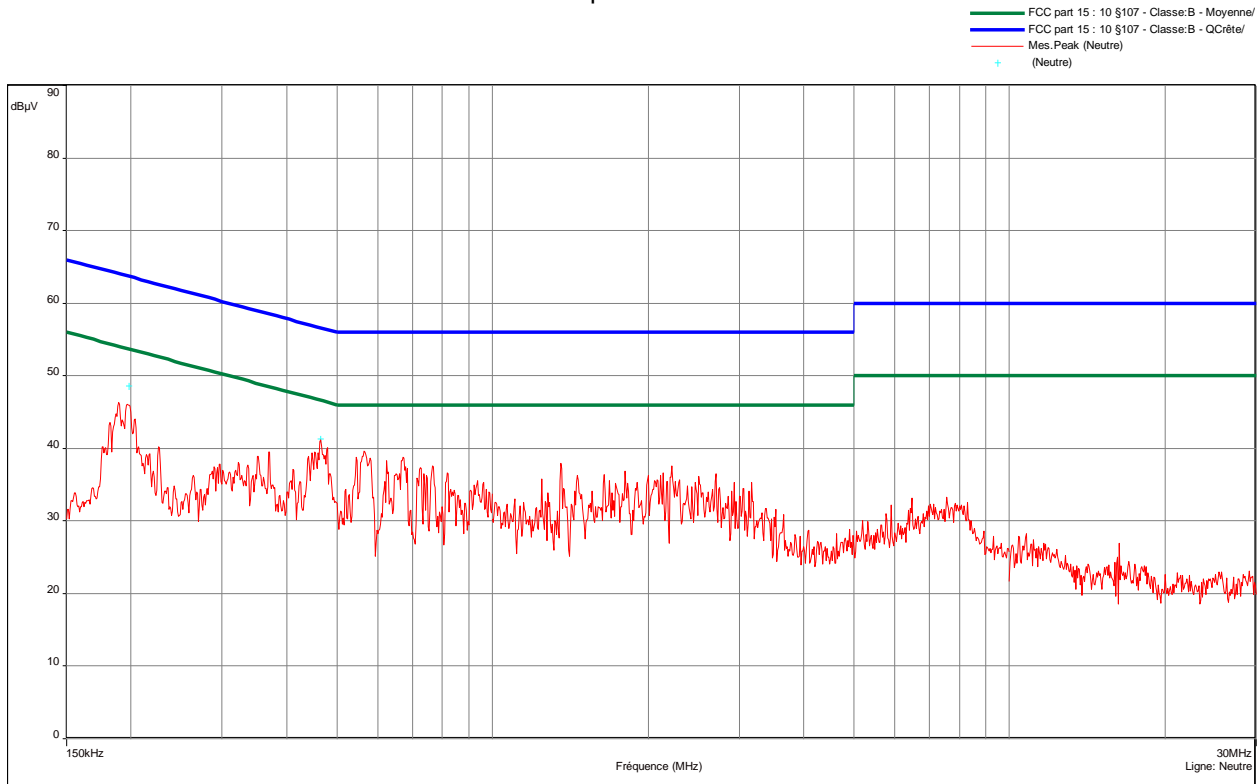
The frequencies which are not 6 dB under the average limit are then analyzed with Quasi-peak detector and Average detector.

F (MHz)	Pk (dBµV)	Qp (dBµV)	lim QP (dBµV)	margin QP (dB)	Av (dBµV)	lim Av (dBµV)	Margin Av (dB)
0.179495	55.58	47.09	64.509	17.419	36.15	54.509	18.359
0.269595	47.65	39.88	61.13	21.25	27.93	51.13	23.2
0.35672	40.84	34.67	58.805	24.135	22.72	48.805	26.085
0.431945	40.14	33.03	57.215	24.185	23.97	47.215	23.245
0.600925	39.38	34.65	56	21.35	21.98	46	24.02

Sample N° 1: with CLAW accessory

Measurement on the mains power supply:

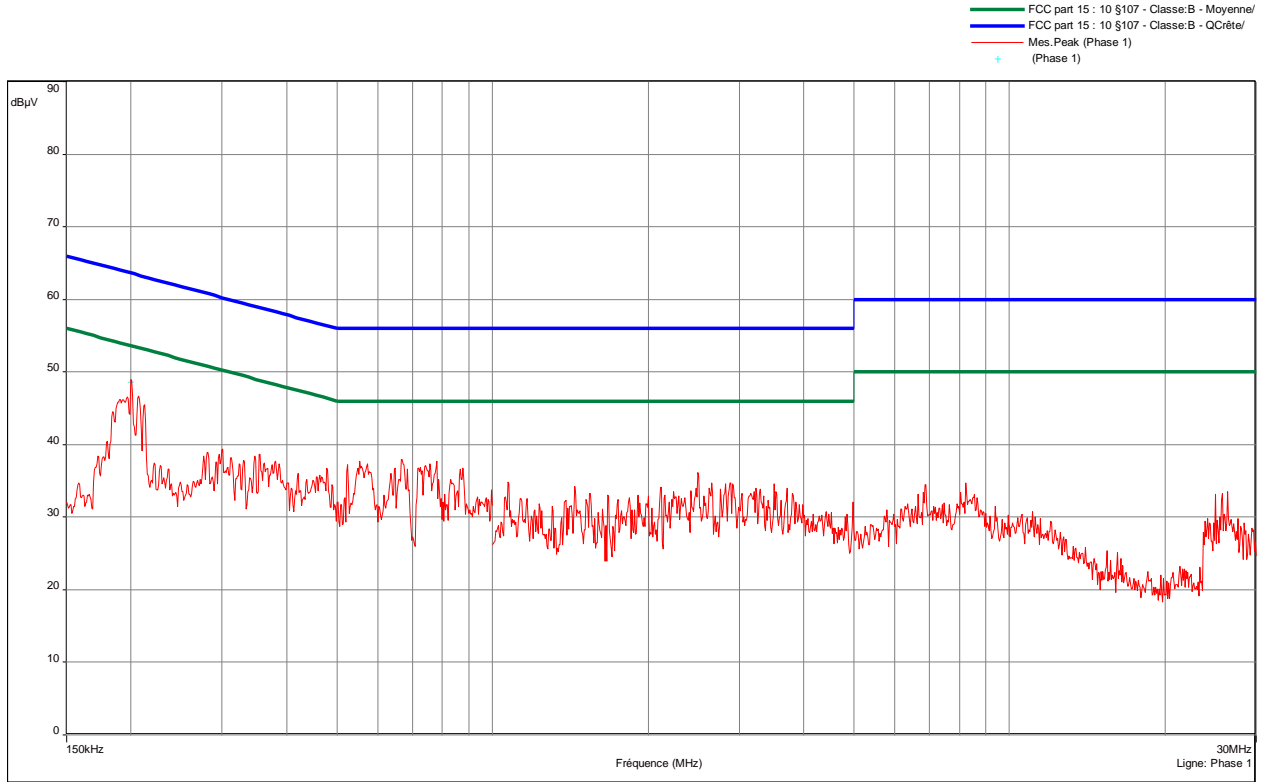
Curve N° 3: measurement on the Neutral with peak detector



The frequencies which are not 6 dB under the average limit are then analyzed with Quasi-peak detector and Average detector.

F (MHz)	Pk (dBµV)	Qp (dBµV)	lim QP (dBµV)	margin QP (dB)	Av (dBµV)	lim Av (dBµV)	Margin Av (dB)
0.19777	48.57	42.79	63.62	20.83	33.34	53.62	20.28
0.465095	41.28	35.97	56.601	20.631	23.5	46.601	23.101

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



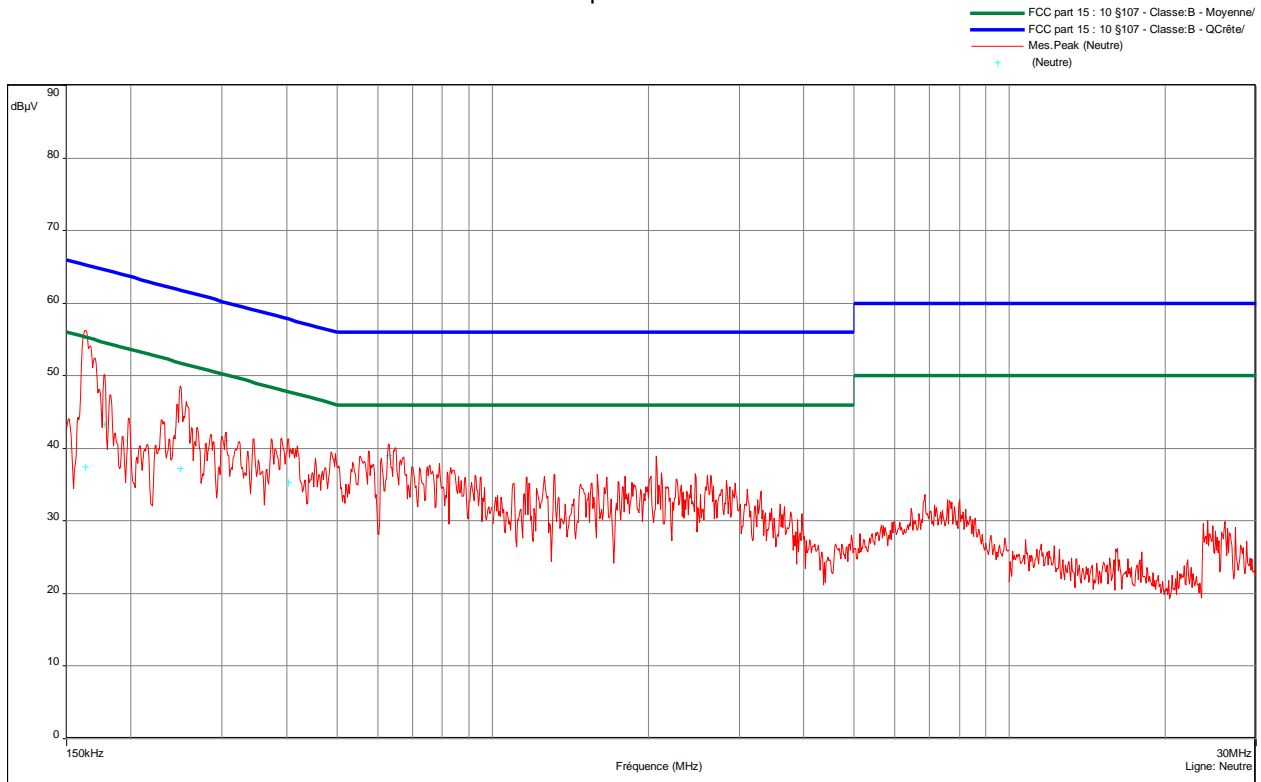
The frequencies which are not 6 dB under the average limit are then analyzed with Quasi-peak detector and Average detector.

F (MHz)	Pk (dBµV)	Qp (dBµV)	lim QP (dBµV)	margin QP (dB)	Av (dBµV)	lim Av (dBµV)	Margin Av (dB)
0.199725	48.58	42.36	63.622	21.262	34.32	53.622	19.302

Sample N° 1: with LIGHT accessory

Measurement on the mains power supply:

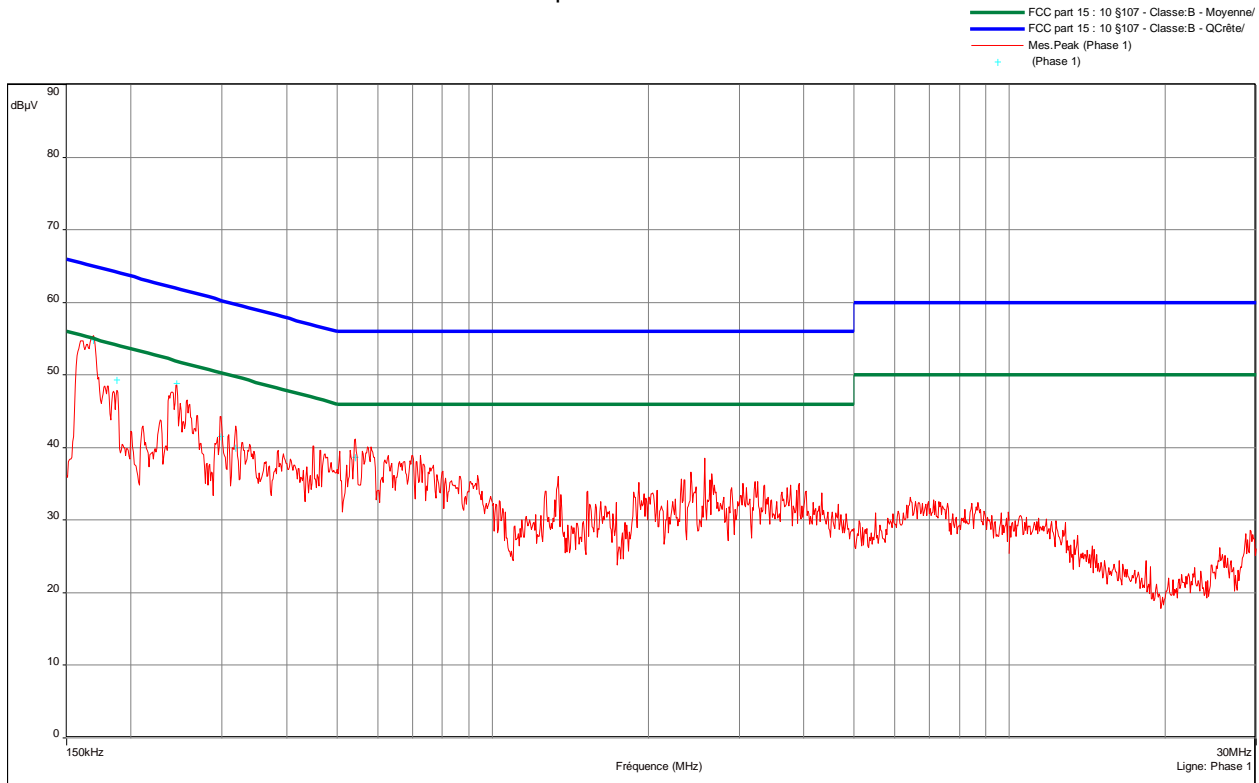
Curve N° 5: measurement on the Neutral with peak detector



The frequencies which are not 6 dB under the average limit are then analyzed with Quasi-peak detector and Average detector.

F (MHz)	Pk (dBµV)	Qp (dBµV)	lim QP (dBµV)	margin QP (dB)	Av (dBµV)	lim Av (dBµV)	Margin Av (dB)
0.163345	37.45	30.17	65.292	35.122	23.1	55.292	32.192
0.17754	43.38	35	64.6	29.6	25.83	54.6	28.77
0.249195	37.18	29.37	61.784	32.414	22.24	51.784	29.544
0.304955	41.09	34.3	60.107	25.807	24.78	50.107	25.327
0.40245	35.26	29.15	57.803	28.653	17.92	47.803	29.883
0.629825	38.99	32.88	56	23.12	16.69	46	29.31

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



The frequencies which are not 6 dB under the average limit are then analyzed with Quasi-peak detector and Average detector.

F (MHz)	Pk (dBµV)	Qp (dBµV)	lim QP (dBµV)	margin QP (dB)	Av (dBµV)	lim Av (dBµV)	Margin Av (dB)
0.16887	54.78	49.08	65.016	15.936	37.45	55.016	17.566
0.187825	49.25	39.37	64.132	24.762	28.33	54.132	25.802
0.244605	48.85	40.95	61.938	20.988	24.88	51.938	27.058
0.297815	41.54	34.6	60.304	25.704	27.95	50.304	22.354
0.318555	39.99	32.93	59.744	26.814	24.08	49.744	25.664
0.54219	38.7	33.58	56	22.42	21.96	46	24.04

Test conclusion:

RESPECTED STANDARD

8. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class 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 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 12.5GHz (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:

First, measures with the drone in stand-alone blocked in reception mode are performed.

Then, measures with the drone in charging mode via an adapter AC/DC supplied with 120Vac – 60Hz are performed.

Results with the drone in stand-alone blocked in reception modeSample 2

Ambient temperature (°C):	21.8
Relative humidity (%):	47

Power source: LiPo battery, 3.7Vdc fully charged

Not any spurious has been observed.

Results with the drone in charging mode via an adapter AC/DC supplied with 120Vac – 60Hz.Sample 2

Ambient temperature (°C):	24.4
Relative humidity (%):	50

Power source: Adapter AC / DC supplied with 120Vac – 60Hz

Not any spurious has been observed.

Test conclusion:

RESPECTED STANDARD

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

The measure is then repeated with the hopping function deactivated.

The measure has been performed on the accessory considered as the more critical (the Claw).

Results:

Ambient temperature (°C): 21.2

Relative humidity (%): 36

Power source: LiPo battery, 3.7Vdc 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 with hopping mode off

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2402	91.8	PEAK	2399.99	-43.9	47.9	71.8	23.9
2480	93.7	PEAK	2483.71	-43.1	50.6	74	23.4
2480	93.7	AVERAGE	2483.51	-55.3	38.4	54	15.6

* *Marker-Delta method*

Sample N° 1 with hopping mode on

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2402	91.8	PEAK	2399.99	-44.0	47.8	71.8	24
2480	93.7	PEAK	2483.53	-42.3	51.4	74	22.6
2480	93.7	AVERAGE	2483.51	-56.5	37.2	54	16.8

* *Marker-Delta method*

20 dB bandwidth curves are given in appendix 5; band-edge curves are given in appendix 7.

Test conclusion:

RESPECTED STANDARD

10. 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 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 1MHz (> 20 dB BW) and video bandwidth at 3MHz.

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.

The maximum peak output power has been performed on the drone equipped with the three different accessories.

Results: Drone equipped with GUN accessory

Ambient temperature (°C): 26.3
Relative humidity (%): 53

Power source: LiPo battery, 3.7Vdc fully charged

Sample N° 1 Low Channel (F=2402MHz)

	Electro-magnetic field (dB μ V/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	93.4	0.00043	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 102 degrees)

Sample N° 1 Central Channel (F=2440MHz)

	Electro-magnetic field (dB μ V/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	94.3	0.00053	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 102 degrees)

Sample N° 1 High Channel (F=2480MHz)

	Electro-magnetic field (dB μ V/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	93.5	0.00044	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 102 degrees)

* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1.53$

Results: Drone equipped with CLAW accessory

Ambient temperature (°C): 21.9
Relative humidity (%): 58

Power source: LiPo battery, 3.7Vdc fully charged

Sample N° 1 Low Channel (F=2402MHz)

	Electro-magnetic field (dBµV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	92.1	0.00032	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 129 degrees)

Sample N° 1 Central Channel (F=2440MHz)

	Electro-magnetic field (dBµV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	94.5	0.00055	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 129 degrees)

Sample N° 1 High Channel (F=2480MHz)

	Electro-magnetic field (dBµV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	93.7	0.00046	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 102 degrees)

* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1.53$

Results: Drone equipped with LIGHT accessory

Ambient temperature (°C): 24.8
Relative humidity (%): 56

Power source: LiPo battery, 3.7Vdc fully charged

Sample N° 1 Low Channel (F=2402MHz)

	Electro-magnetic field (dBµV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	89.3	0.00017	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 222 degrees)

Sample N° 1 Central Channel (F=2440MHz)

	Electro-magnetic field (dBµV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	92.8	0.00037	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 222 degrees)

Sample N° 1 High Channel (F=2480MHz)

	Electro-magnetic field (dBµV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage: 3.7V	93.7	0.00046	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 222 degrees)

* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1.53$

Test conclusion:

RESPECTED STANDARD

11. 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 GHz)

Peak / VBW = 10Hz (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: 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 blocked on low, central then high channel, at the highest output power level at which the transmitter is intended to operate.

The measures have been performed on the drone equipped with the three different accessories.

Results: Drone equipped with GUN accessory

Ambient temperature (°C): 27
Relative humidity (%): 41

Power source: LiPo battery, 3.7Vdc fully charged

Sample N° 1 Low Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4804.5*	P	150	—	1000	H	48.8**	74	25.2
7207.2	P	150	—	100	H	44.7	74.3	29.6

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

* restricted bands of operation in 15.205

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

Sample N° 1 Central Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4883*	P	150	—	1000	V	49.1**	74	24.9
7324.2*	P	150	—	1000	H	48.5**	74	25.5

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

* restricted bands of operation in 15.205

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

Sample N° 1 High Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4960.5*	P	150	—	1000	H	50.7**	74	23.3
7441.2*	P	150	—	1000	H	49.8**	74	24.2

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

* restricted bands of operation in 15.205

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

Results: Drone equipped with CLAW accessory

Ambient temperature (°C): 22.6
Relative humidity (%): 57

Power source: LiPo battery, 3.7Vdc fully charged

Sample N° 1 Low Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4804.5*	P	150	—	1000	H	50.6**	74	23.4
7207.2	P	150	—	100	V	43.5	74.3	30.8

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

* restricted bands of operation in 15.205

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

Sample N° 1 Central Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4883*	P	150	—	1000	H	50.8**	74	23.2
7324.2*	P	150	—	1000	H	49.1**	74	24.9

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

* restricted bands of operation in 15.205

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

Sample N° 1 High Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4960.5*	P	150	—	1000	H	48.4**	74	25.6
7441.2*	P	150	—	1000	V	49.1**	74	24.9

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

* restricted bands of operation in 15.205

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

Sample N° 2: Motors activated

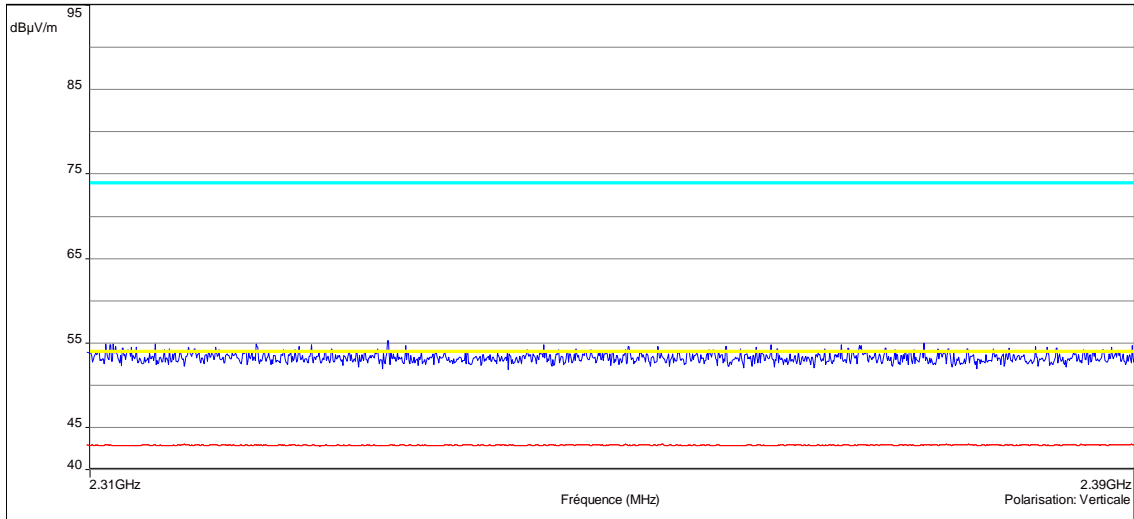
Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
554.72	QP	187	5	120	V	27.26	46	18.74

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

The 3 products possess the same radio. So, only the band edge on the worst case (claw accessory) was taken into account.

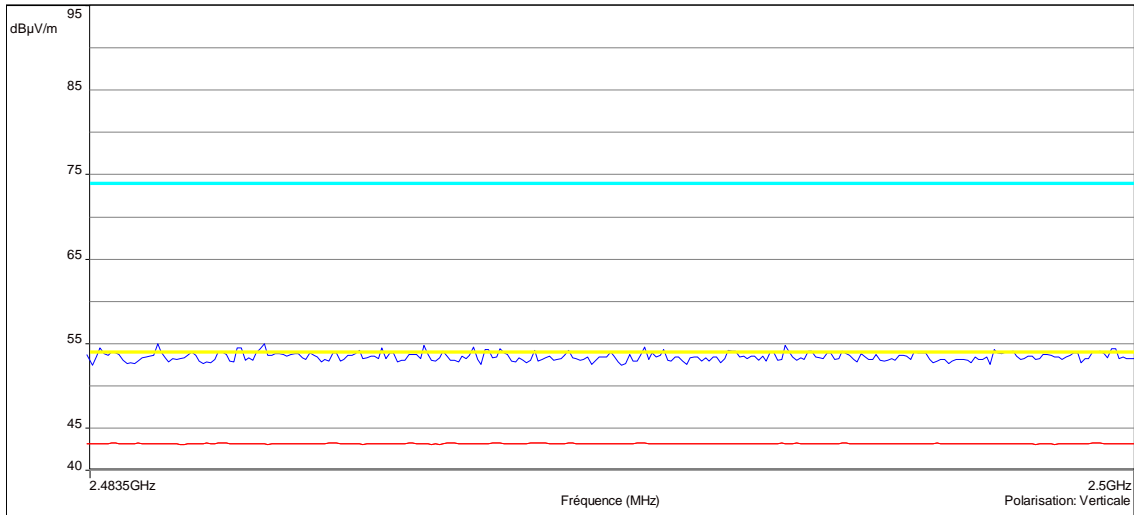
Band edge worst case measurement (band 2310MHz to 2390MHz)

- 15.209 avec bande restrictive - Classe: - Moyenne/3.0m/
- 15.209 avec bande restrictive - Classe: - QCrête/3.0m/
- 15.209 avec bande restrictive - Classe: - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)



Band edge worst case measurement (band 2483.5MHz to 2500MHz)

- 15.209 avec bande restrictive - Classe: - Moyenne/3.0m/
- 15.209 avec bande restrictive - Classe: - QCrête/3.0m/
- 15.209 avec bande restrictive - Classe: - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)



Results: Drone equipped with LIGHT accessory

Ambient temperature (°C): 25.2
Relative humidity (%): 57

Power source: LiPo battery, 3.7Vdc fully charged

Sample N° 1 Low Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4804.5*	P	150	—	1000	H	50**	74	24
7207.2	P	150	—	100	H	42.7	74.3	31.6

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

* restricted bands of operation in 15.205

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

Sample N° 1 Central Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4883*	P	150	—	1000	H	51.8**	74	22.2
7324.2*	P	150	—	1000	H	49.7**	74	24.3

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

* restricted bands of operation in 15.205

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

Sample N° 1 High Channel

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4960.5*	P	150	—	1000	H	49.1**	74	24.9
7441.2*	P	150	—	1000	H	50.3**	74	23.7

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

* restricted bands of operation in 15.205

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

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 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 94.3dB μ V/m on central channel.

So the applicable limit is 74.3dB 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, 10 appendixes to be forwarded □□□

APPENDIX 1: Photos of the equipment under test

| Refer External View ParrotMAMBO.pdf document
Refer Internal View ParrotMAMBO.pdf document

CONFIDENTIAL

APPENDIX 2: Test set up

Refer Tsup.pdf document

CONFIDENTIAL

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 R&S ESU8	Rohde & Schwarz	9403
LISN 1600	Thurby Thandar Instruments 1600	8719
High-pass filter EZ-25	Rohde & Schwarz	8635
Absorber sheath current	Emitech	10651
Power source 1251RP	California instruments	8508
Multimeter 177	FLUKE	10318
Meteo station	HUGER	8671
Software	BAT-EMC	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
Antenna 3115	Electrometrics	8535
Low-noise amplifier 8447D	Hewlett Packard	8511
Log periodic antenna 3147	EMCO	8783
Low-noise amplifier S005180M3201	LUCIX Corp	10739
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Bluetooth testor CBT32	Rohde & Schwarz	11370
Software	BAT-EMC	0000

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 IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8750
Bluetooth testor CBT32	Rohde & Schwarz	11370
Software	GPIB SHOT	/

Maximum peak output power

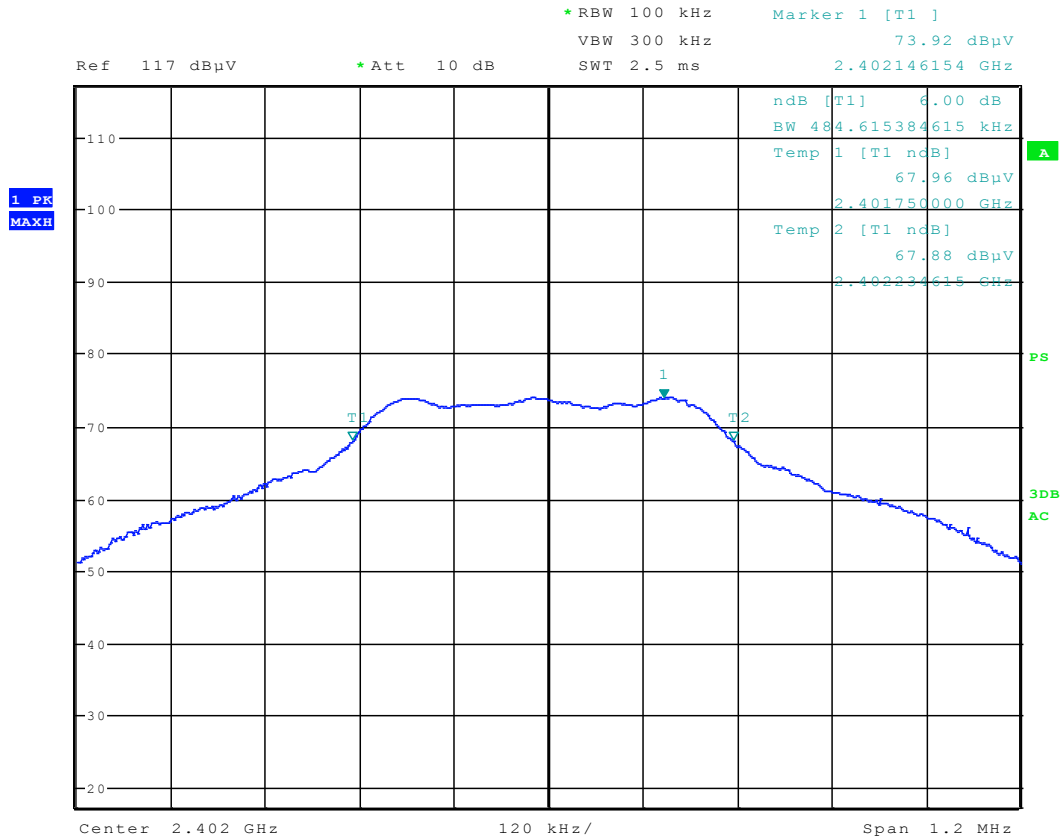
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	Electrometrics	8535
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8750
Bluetooth testor CBT32	Rohde & Schwarz	11370
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 S005180M3201	LUCIX Corp	10739
Low-noise amplifier ALN02-0102	ALC Microwave	3036
Low pass Filter LP03/1000-7GH	FILTEK	4087
Reject band filter BRM50702	Microtronics	7299
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Bluetooth tester CBT32	Rohde & Schwarz	11370
Software	BAT-EMC	0000

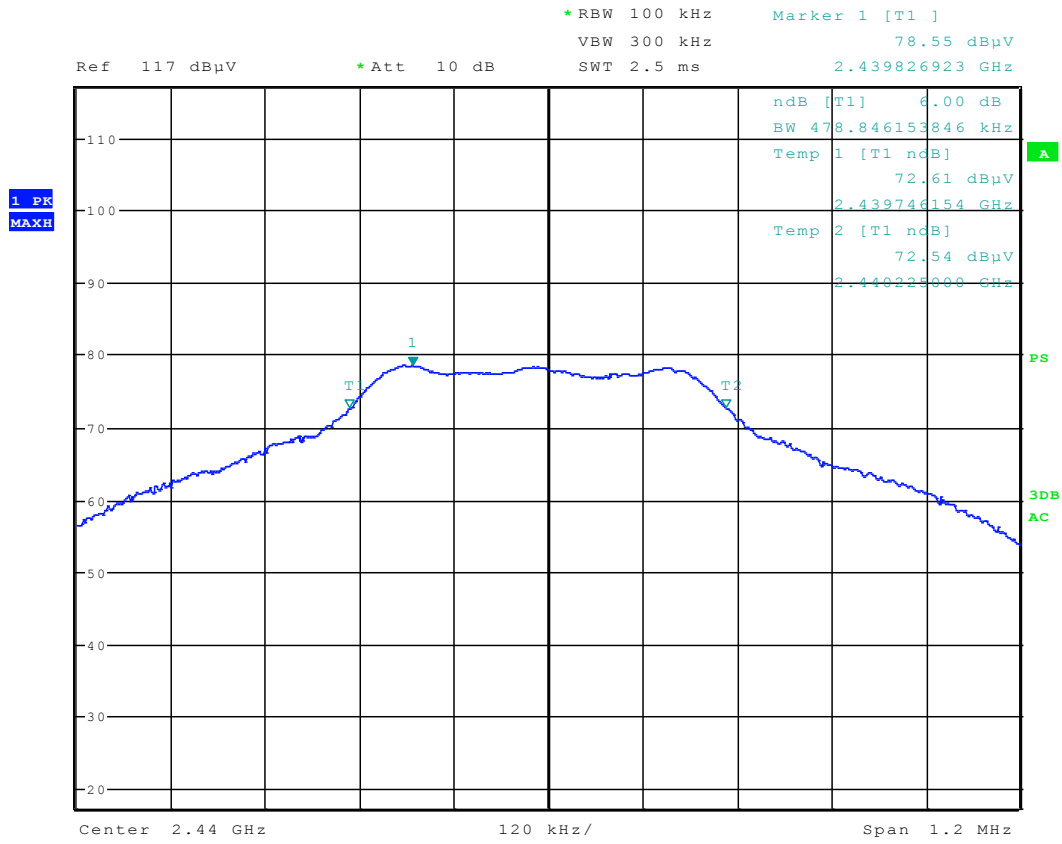
APPENDIX 4: 6 dB bandwidth

Low channel



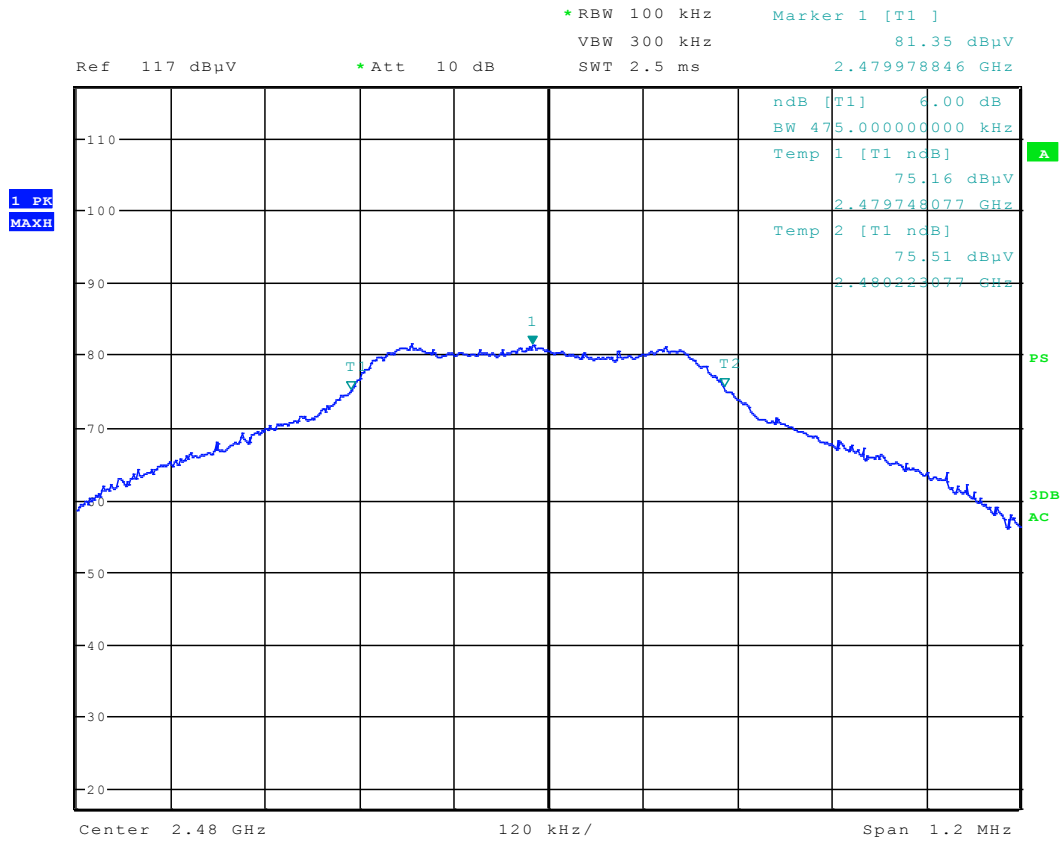
Date: 8.JUN.2005 01:15:54

Central channel



Date: 8.JUN.2005 02:30:57

High Channel



Date: 8.JUN.2005 02:33:07

APPENDIX 5: 20 dB bandwidth

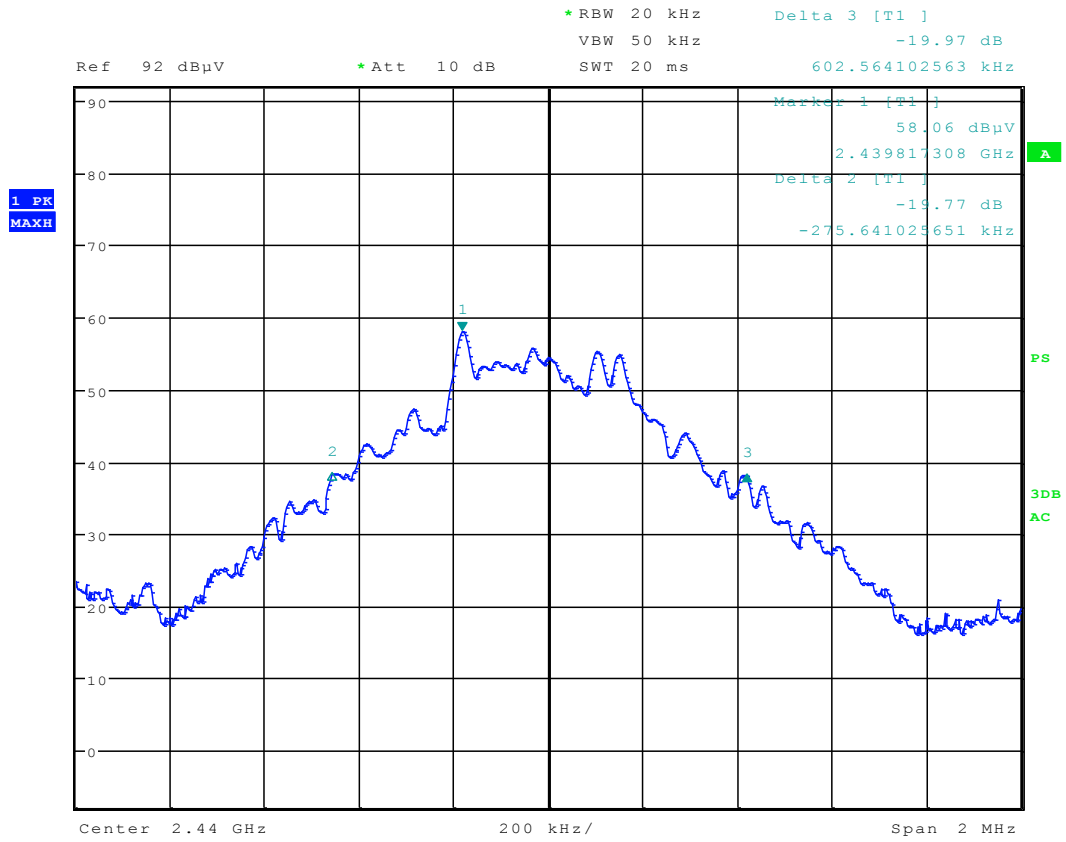
Low channel



Date: 3.JUL.2005 21:47:15

20 dB BW: 852.56 kHz

Central channel



Date: 3.JUL.2005 21:43:38

20 dB BW: 878.2 kHz

High channel



Date: 3.JUL.2005 21:42:04

20 dB BW: 842 kHz

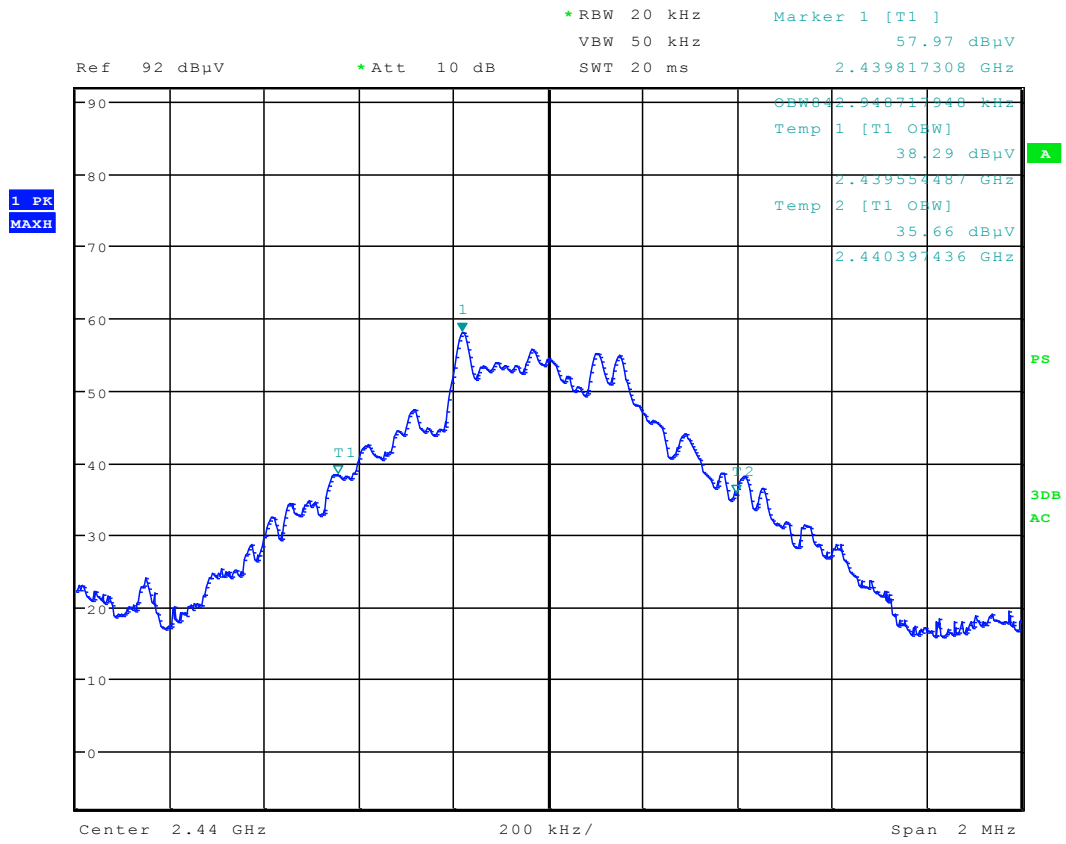
APPENDIX 6: 99% bandwidth

Low channel



Date: 3.JUL.2005 21:45:53

Central channel



Date: 3.JUL.2005 21:44:19

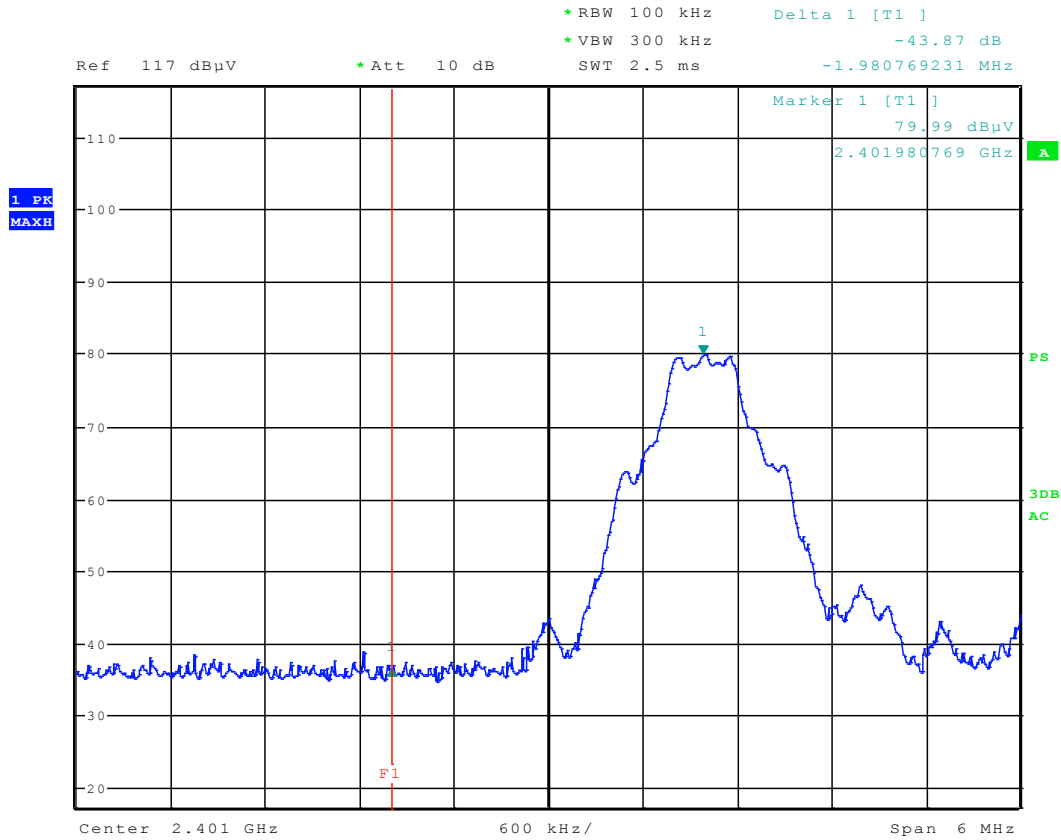
High channel



Date: 3.JUL.2005 21:39:42

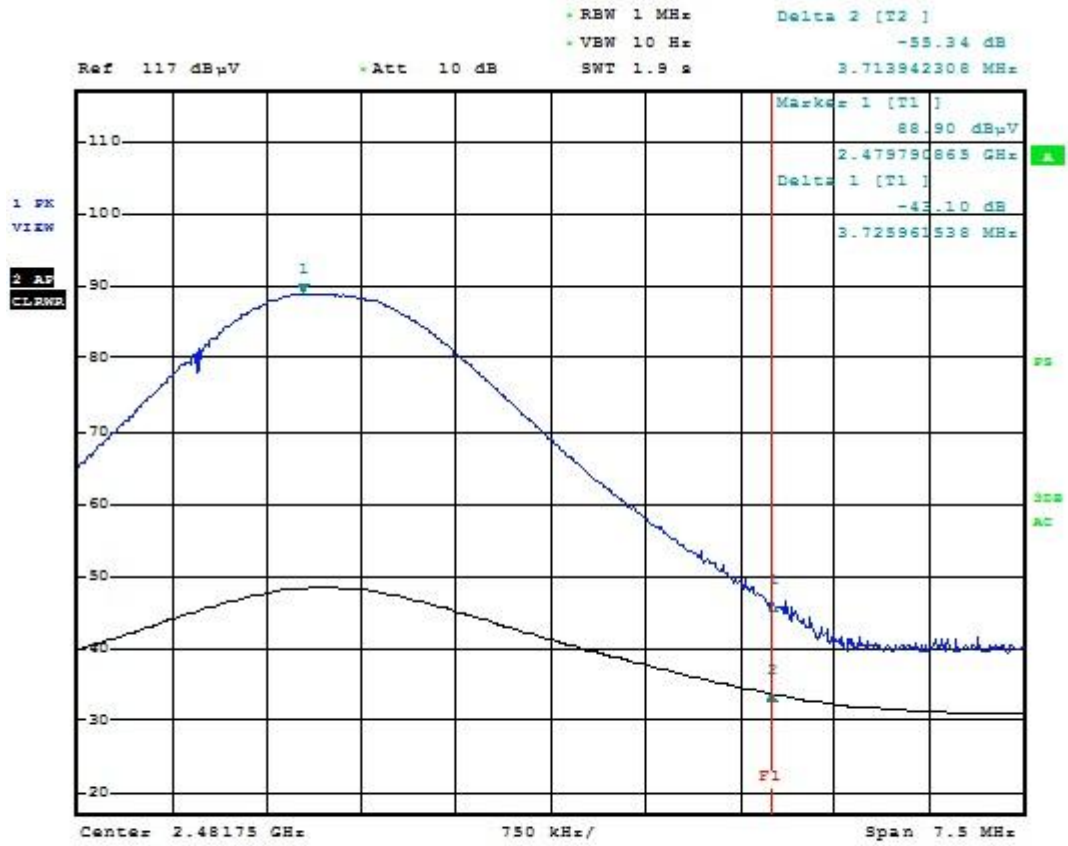
APPENDIX 7: Band edge

Low channel with hopping mode off



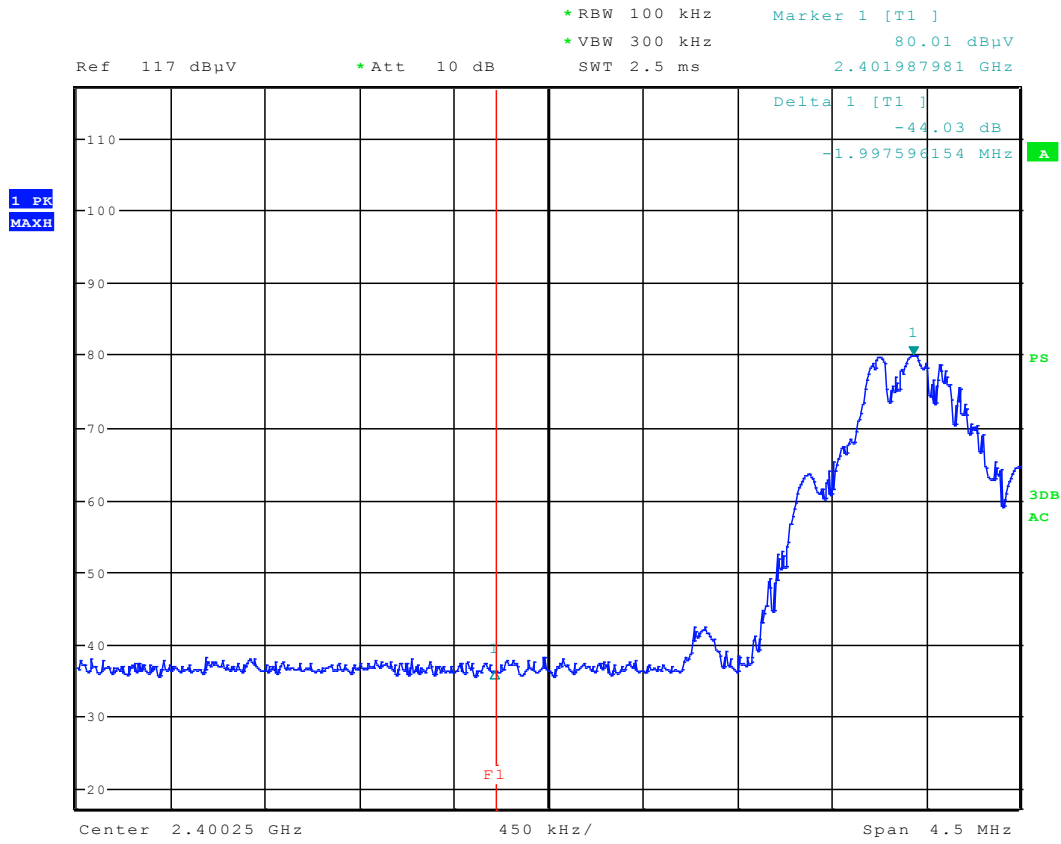
Date: 8.JUN.2005 02:58:28

High channel with hopping mode off



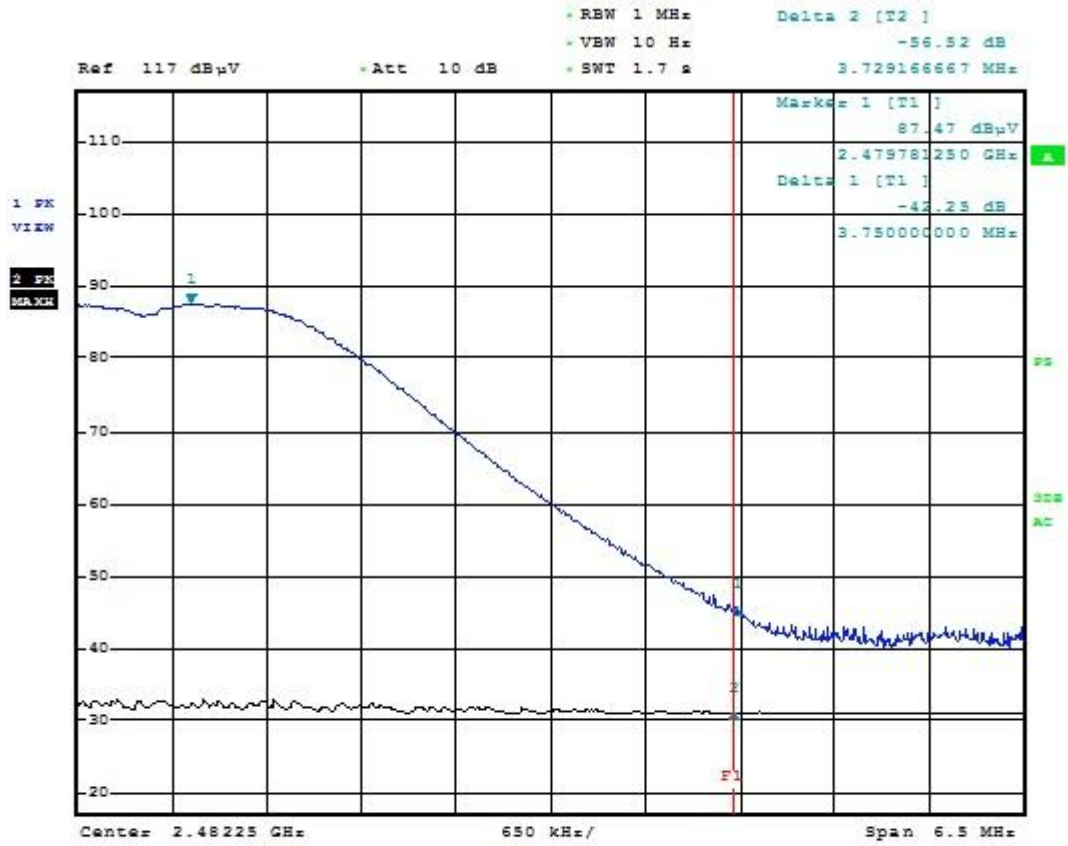
Date: 8 JUN 2005 02:46:01

Low channel with hopping mode on



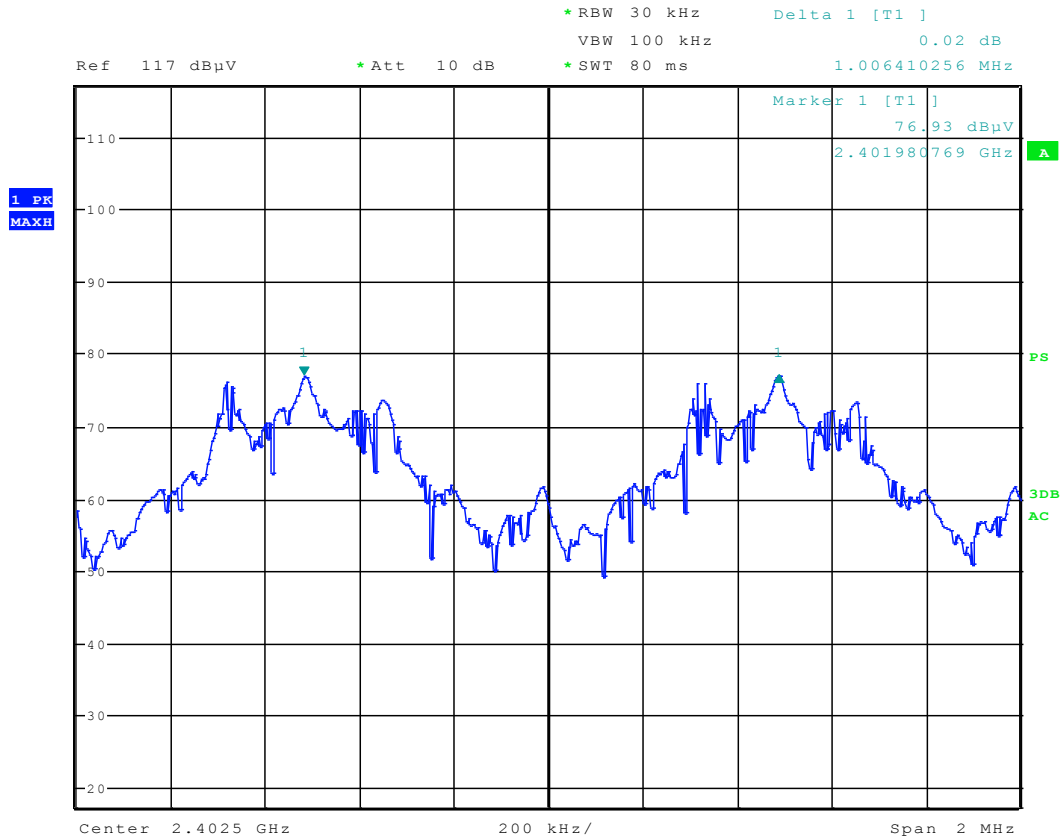
Date: 8.JUN.2005 03:04:18

High channel with hopping mode on



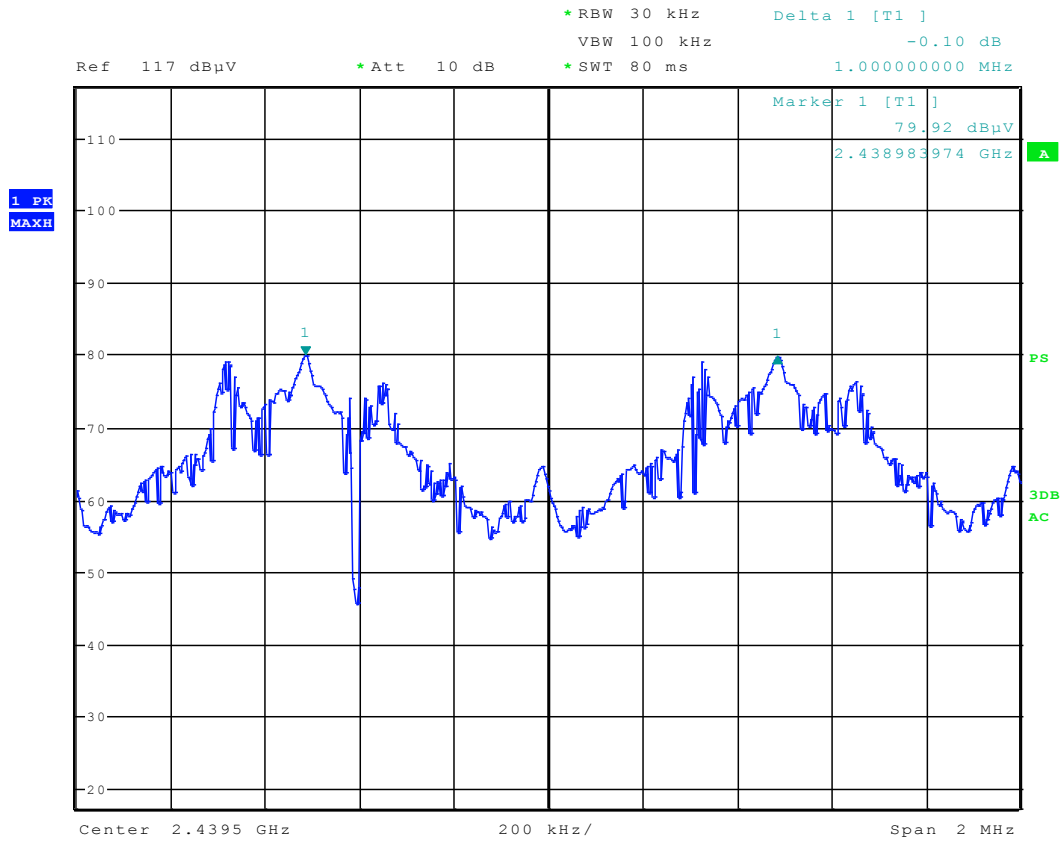
APPENDIX 8: Channel spacing

Low channel



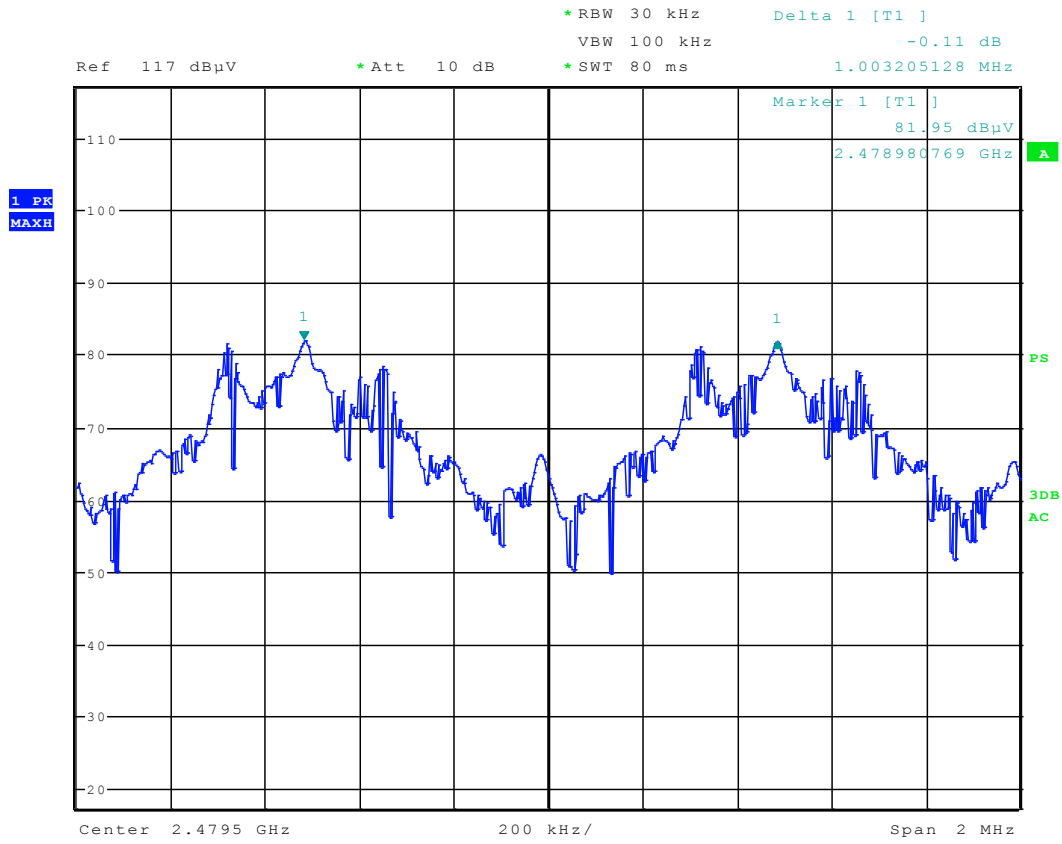
Date: 8.JUN.2005 04:16:37

Central channel



Date: 8.JUN.2005 04:19:43

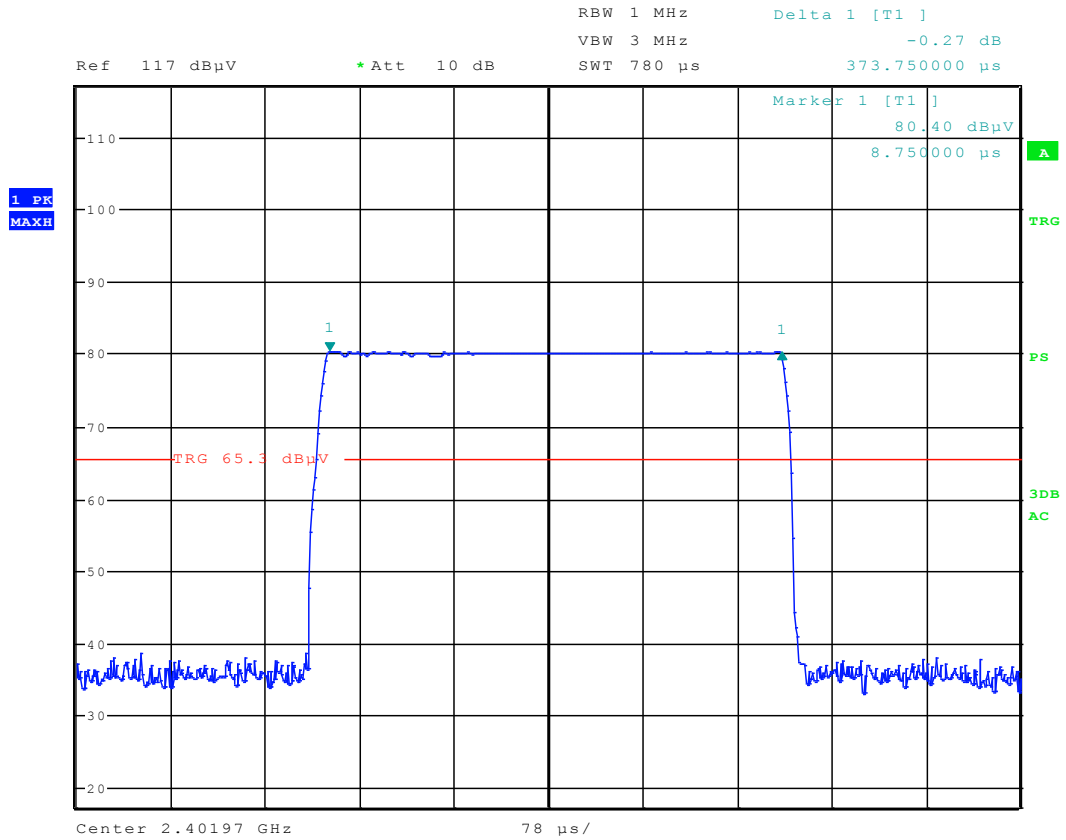
High channel



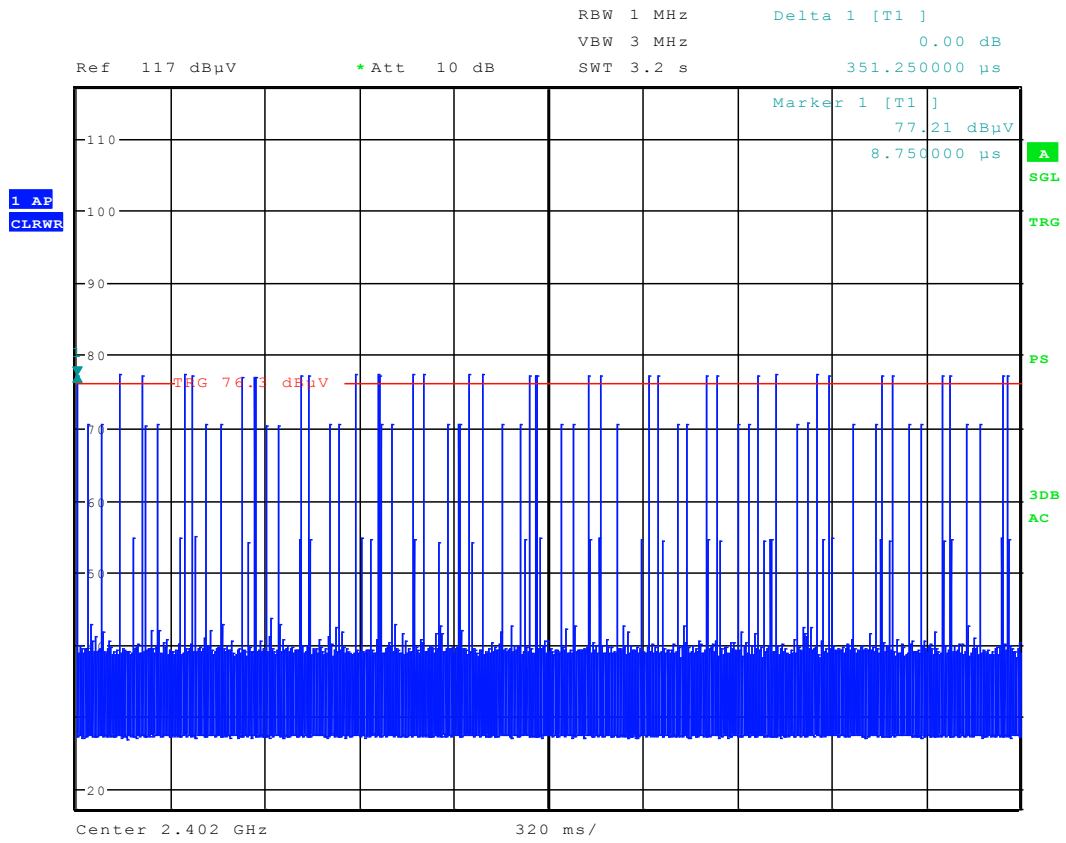
Date: 8.JUN.2005 04:21:58

APPENDIX 9: Time of occupancy on any frequency

Low channel

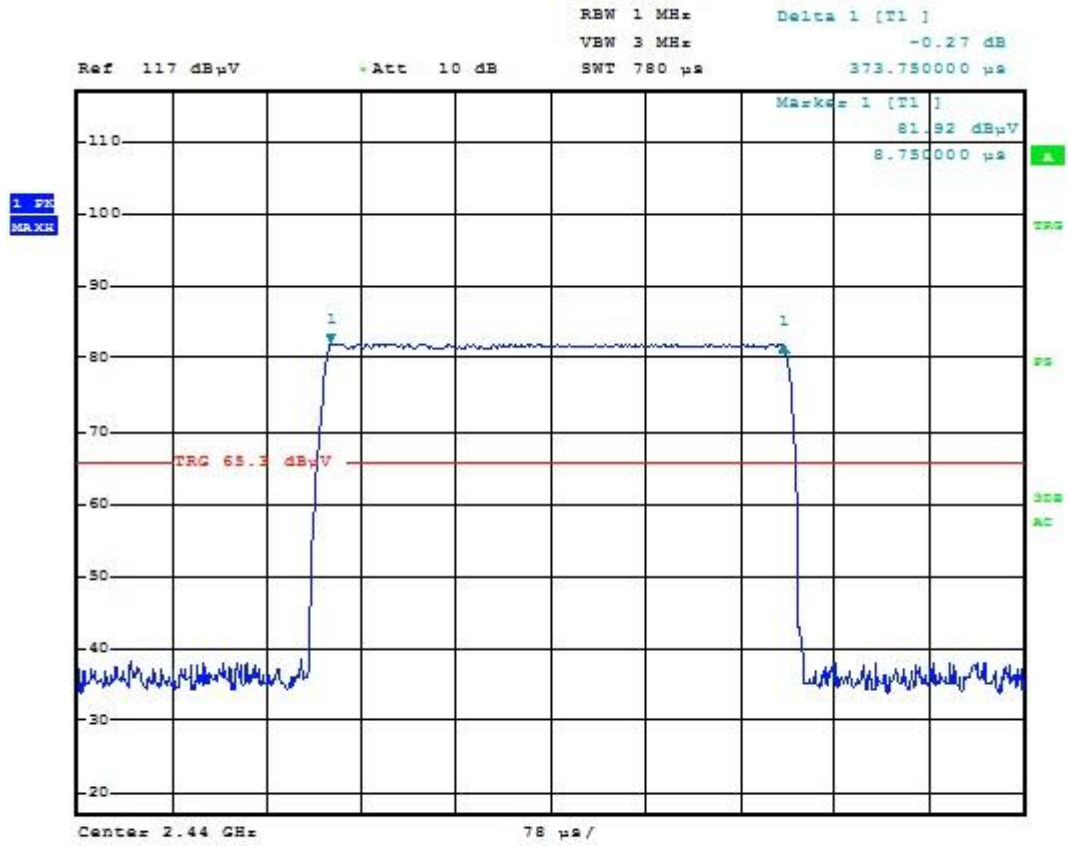


Date: 8.JUN.2005 03:32:56

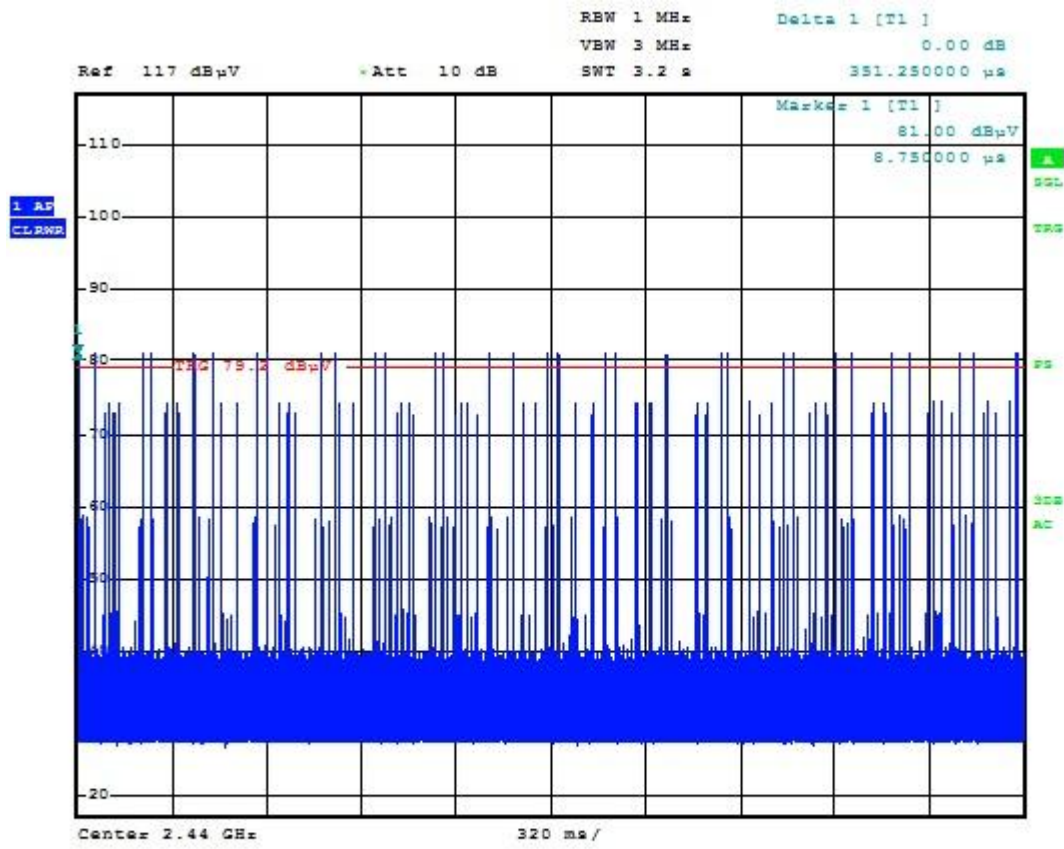


Date: 8.JUN.2005 04:01:29

Central channel

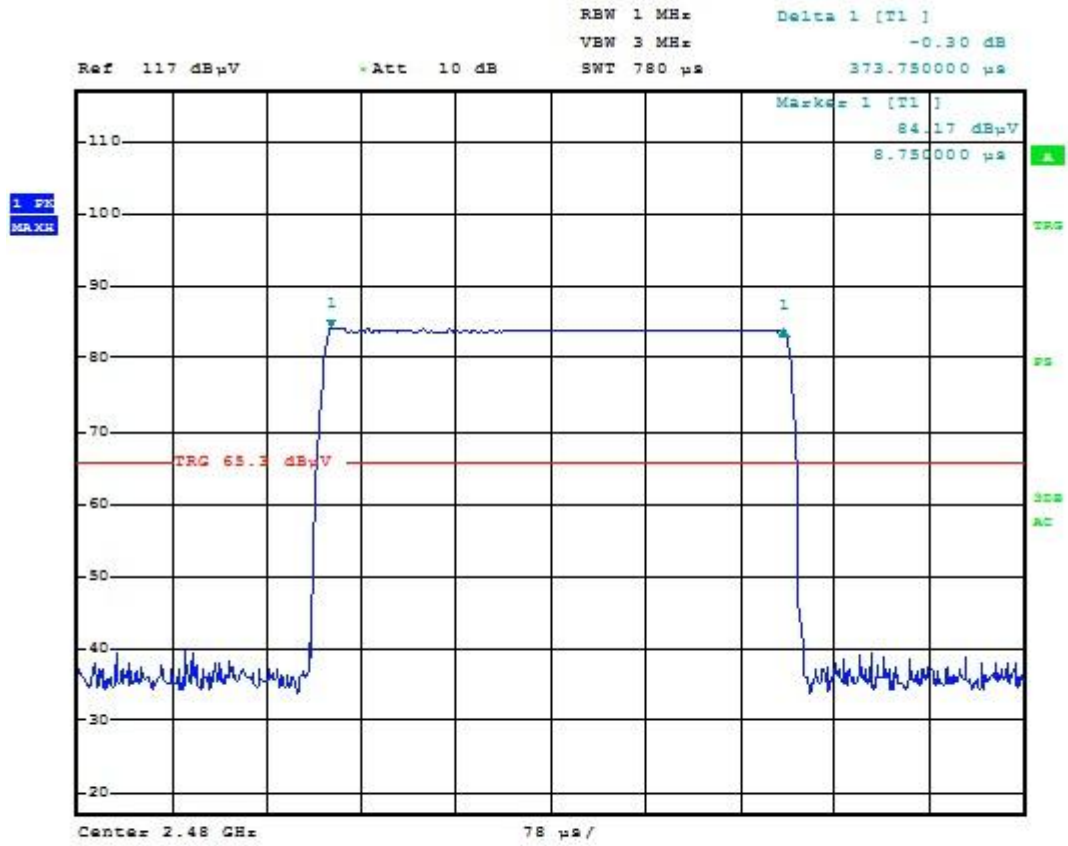


Date: 8.JUN.2005 03:54:37

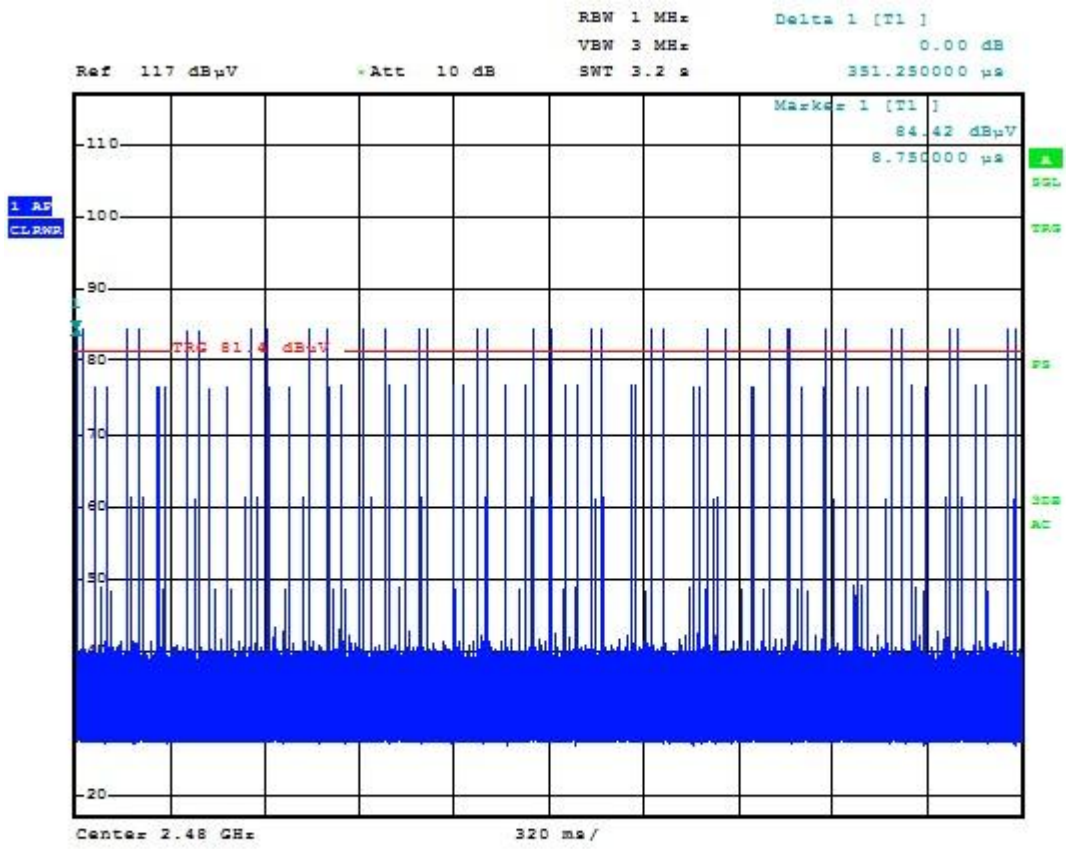


Date: 8.JUN.2005 04:00:14

High channel

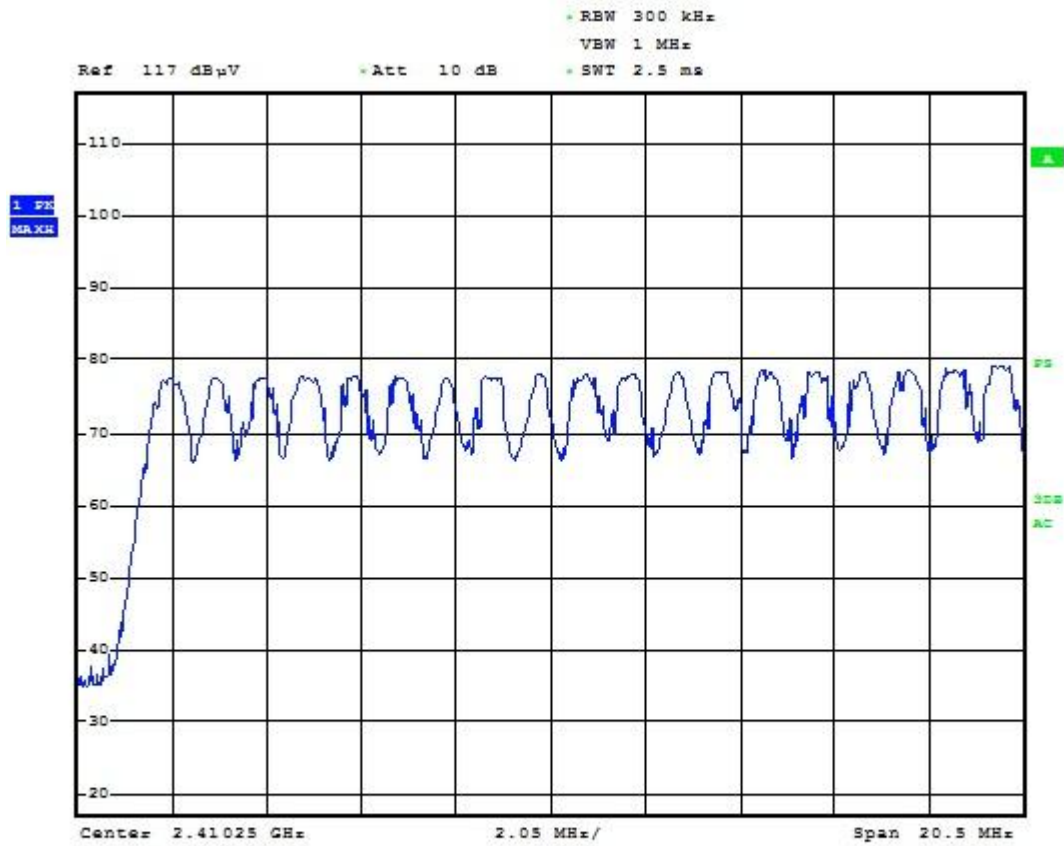


Date: 8.JUN.2005 03:55:19

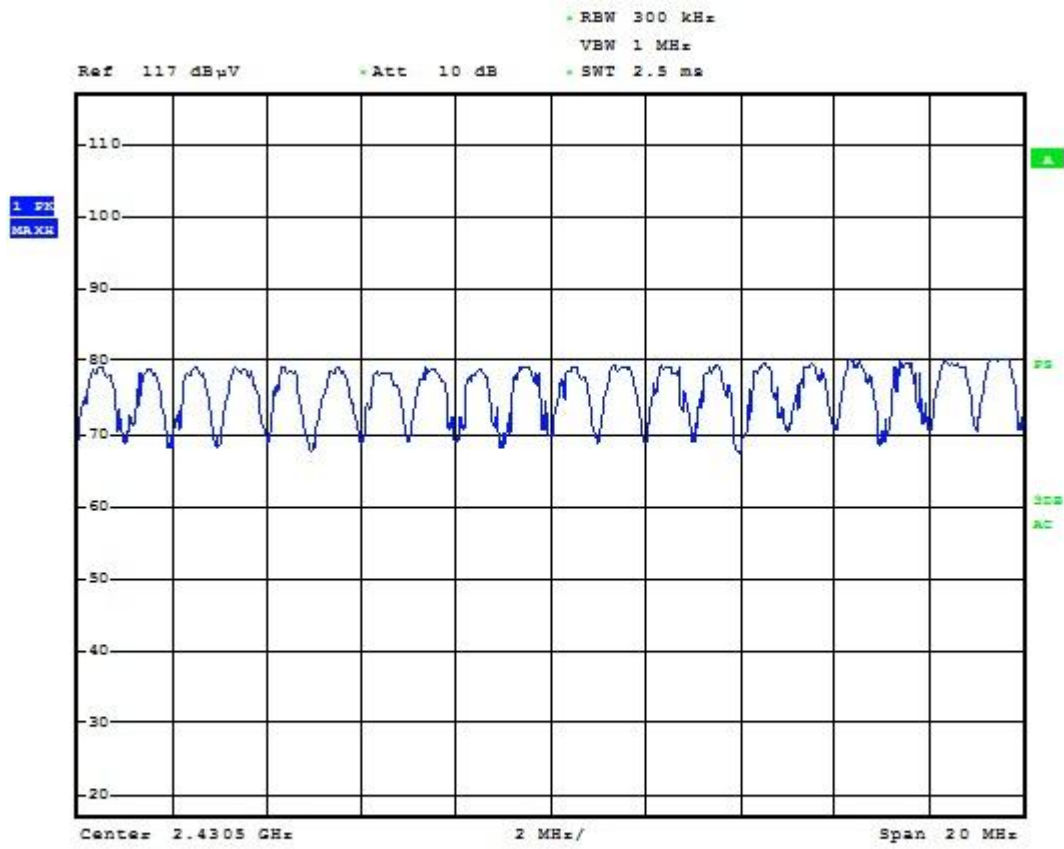


Date: 8.JUN.2005 03:59:20

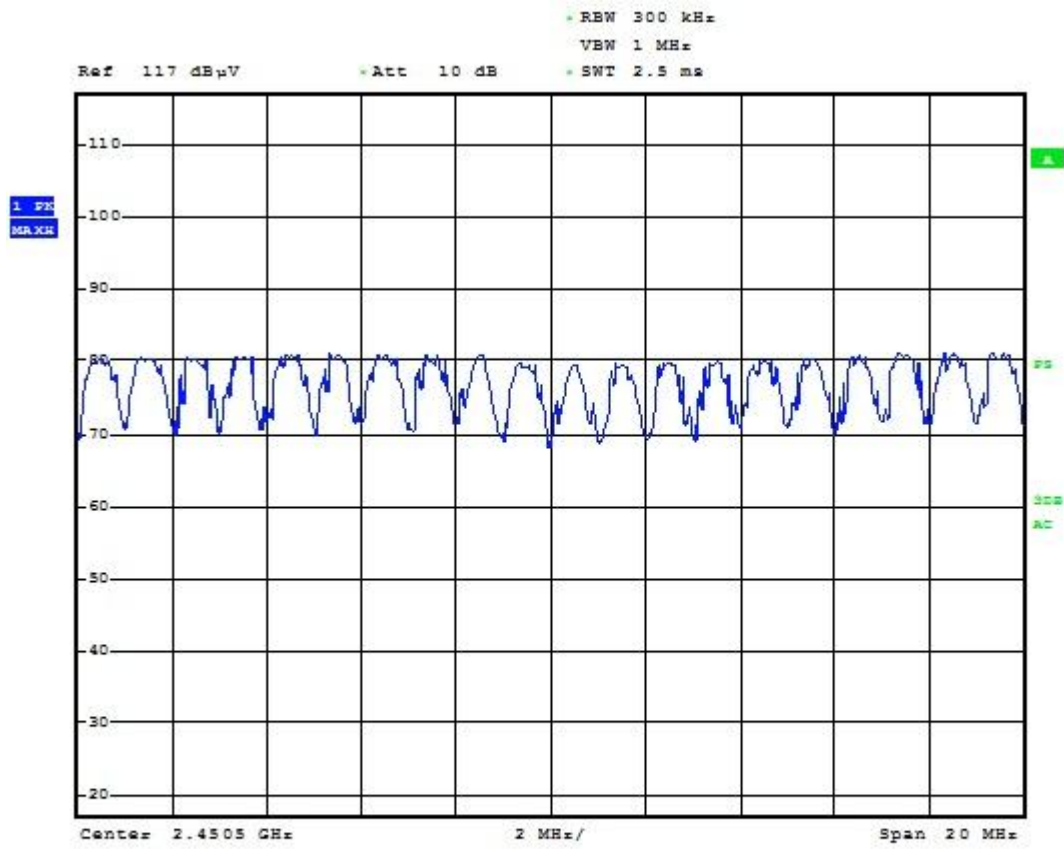
APPENDIX 10: Number of hopping channels



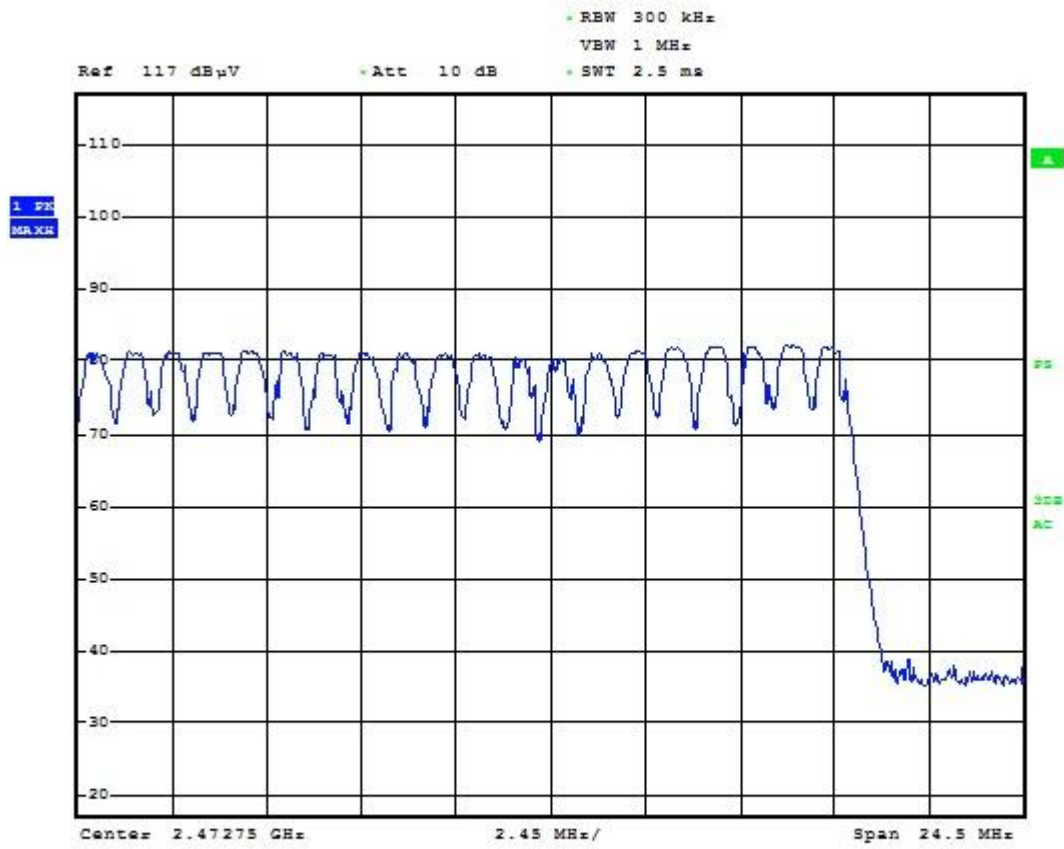
Date: 8.JUN.2005 04:09:06



Date: 8.JUN.2005 04:10:32



Date: 8.JUN.2005 04:11:13



Date: 8.JUN.2005 04:12:13