RR051-15-101627-4-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: 30 with 6 appendixes

Ed.	Date	Modified pages	Written by Name Visa	Technical Verification and Quality Approval Name Visa
0	6-JUN-2015	Creation	T. LEDRESSEUR T.L	O. ROY

DESIGNATION OF PRODUCT:	Parrot minidrones
Serial number (S/N):	LFUZ5D00CAA
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

CONTENTS

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:	40
Channel spacing:	2 MHz
Modulation:	Bluetooth Low Energy
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.
558074 D01 DTS v03r03	Guidance for Performing Compliance on Digital Transmission Systems Operating under §15.247

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		
	(a) (2) Digital modulation techniques	X				*Note 5*
	(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 minimum 6 dB bandwidth of the equipment is 660 kHz (see appendix 4).

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 = 103 dBµV/m = 5.99 mW

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

PSD = EIRP/4*π*R2=5.99 / 4*π*(20 cm)² = 1.19E-03 mW/cm² (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:

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)*
2402	101	PEAK	2399.32	44.15	56.85	81	24.15
2480	102	PEAK	2483.549	37.01	64.99	74	9.01
2480	102	AVERAGE	2483.549	70.28	31.72	54	22.28

* *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:	101	0.00378	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: See photos in appendix 2 (azimuth: 90 degrees)

Sample N° 1 Central Channel

	Electro-magnetic field (dBµV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage:	103	0.00599	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: See photos in appendix 2 (azimuth: 90 degrees)

Sample N° 1 High Channel

	Electro-magnetic field (dBµV/m):	Conducted power * (W)	Limit (W)
Nominal supply voltage:	102	0.00475	1

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: See photos in appendix 2 (azimuth: 90 degrees)

** $P = (E \times d)^2 / (30 \times Gp)$ with d = 3 m and Gp = 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 GHz) Peak / Average (F > 1 GHz)

Bandwidth: 200Hz (9 kHz < F < 150kHz)
9 kHz (150 kHz < F < 30MHz)
120 kHz (30 MHz < F < 1 GHz)
100 kHz / 1 MHz (F > 1 GHz)

Distance of antenna: 3 meters

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	54.349	74	19.651
4804(1)	Av	1000	V	50.425	54	3.575
7206	P	100	V	45.03	82	36.97

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	56.566	74	17.434
4880(1)	Av	1000	V	53.327	54	0.673
7320(1)	P	1000	V	55.656	74	18.344
7320(1)	Av	1000	V	49.93	54	4.07

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	55.06	74	18.94
4960(1)	Av	1000	V	51.254	54	2.746
7440(1)	P	1000	V	55.202	74	18.798
7440(1)	Av	1000	V	49.18	54	4.82

(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 102 dBµV/m on central channel.
So the applicable limit is 82 dBµV/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

10. PEAK POWER DENSITY

Standard: FCC Part 15

Test procedure: paragraph 15.247 (e)

Test set up:

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.

The measuring distance between the equipment and the test antenna is 3 m. The test antenna has been oriented in two polarizations (Vertical and Horizontal). Only the highest level of each measurement is reported.

We used the same method of the peak output power measurement, but the equipment under test power level is recorded with the spectrum analyzer

Resolution bandwidth: 3 kHz
Video 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): 21.4
Relative humidity (%): 38

Power source: battery fully charged

Sample N° 1 Low Channel

	Peak power density at frequency: 2402 MHz
Normal test conditions	-11.03
Limits	+8 dBm

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: See photos in appendix 2 (azimuth: 90 degrees)

Sample N° 1 Central Channel

	Peak power density at frequency: 2440 MHz
Normal test conditions	-9.03
Limits	+8 dBm

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: See photos in appendix 2 (azimuth: 90 degrees)

Sample N° 1 High Channel

	Peak power density at frequency: 2480 MHz
Normal test conditions	-10.73
Limits	+8 dBm

Polarization of test antenna: Horizontal (height: 150 cm)
Position of equipment: See photos in appendix 2 (azimuth: 90 degrees)

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 6 appendixes to be forwarded □□□

APPENDIX 1: Photos of the equipment under test

CONFIDENTIAL

APPENDIX 2: Test set up

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 HP 8591EM	Hewlett Packard	8524
LISN 1600	Thurbly Thandar Instruments 1600	8719
High-pass filter ETP232	SECRE	8641
Absorber sheath current	Emitech	9489
Power source 1251RP	California instruments	8508
Multimeter MN5102B	AOIP	8675
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
Low-noise amplifier C020180F-4B1	Microwave DB	1922
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
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 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

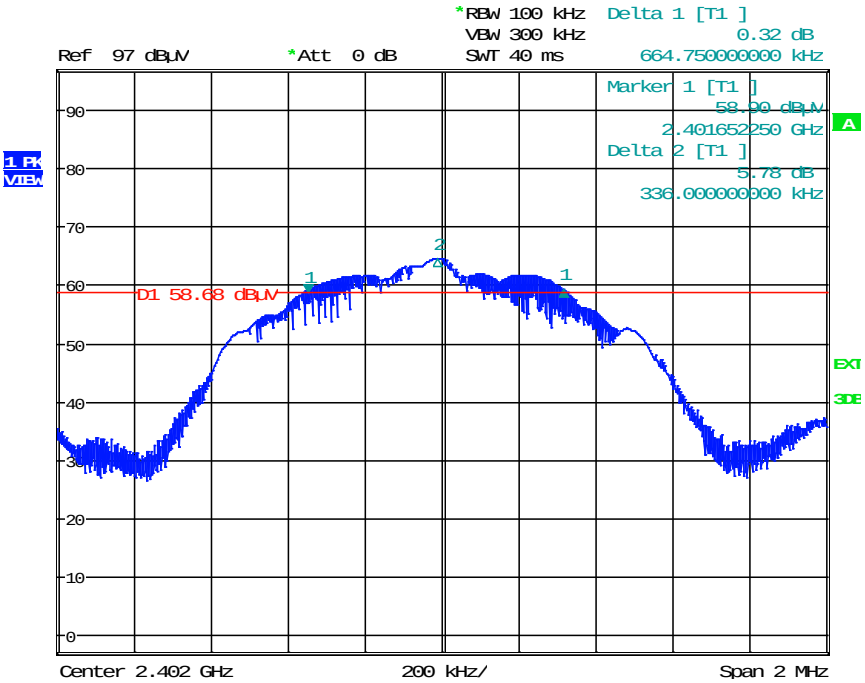
TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna EMCO 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	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

Peak power density

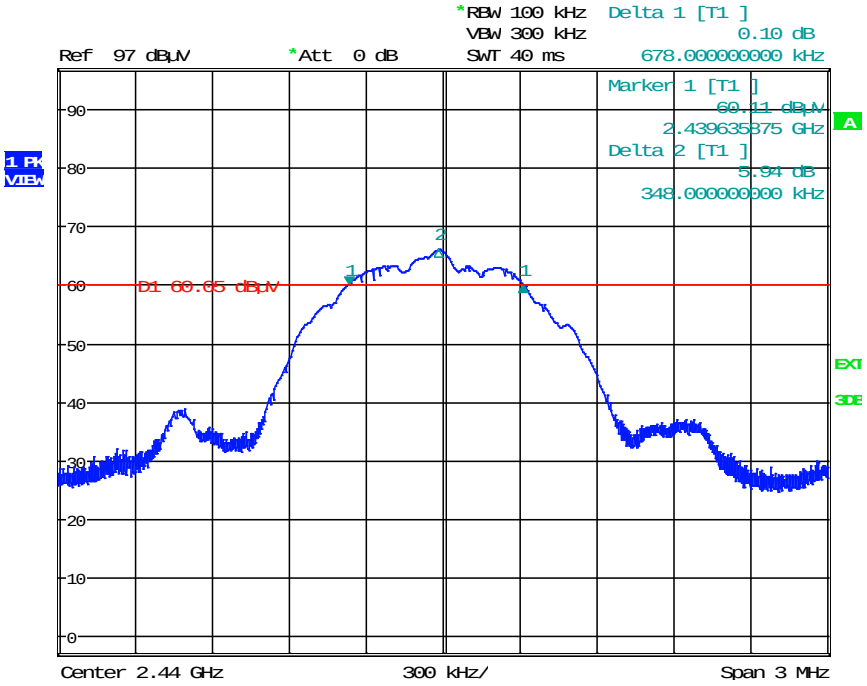
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	Electrometrics	8535
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC	0000

APPENDIX 4: 6 dB bandwidth

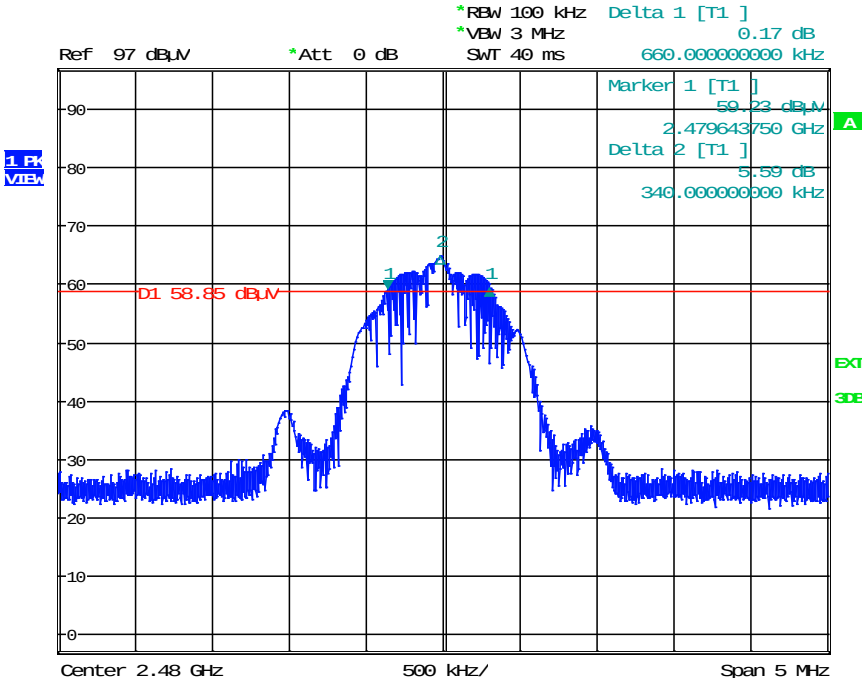
Low channel



Central channel

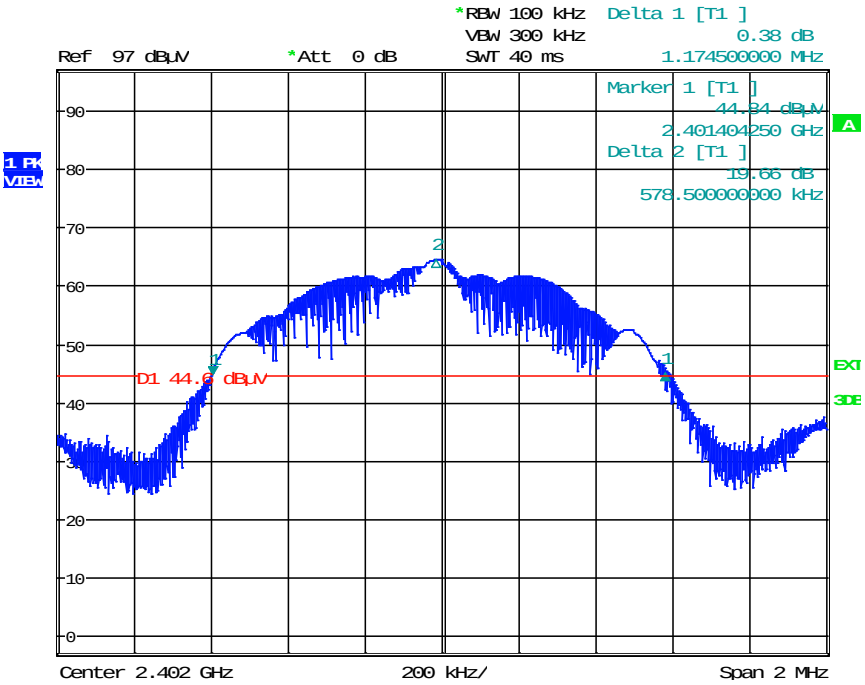


High channel

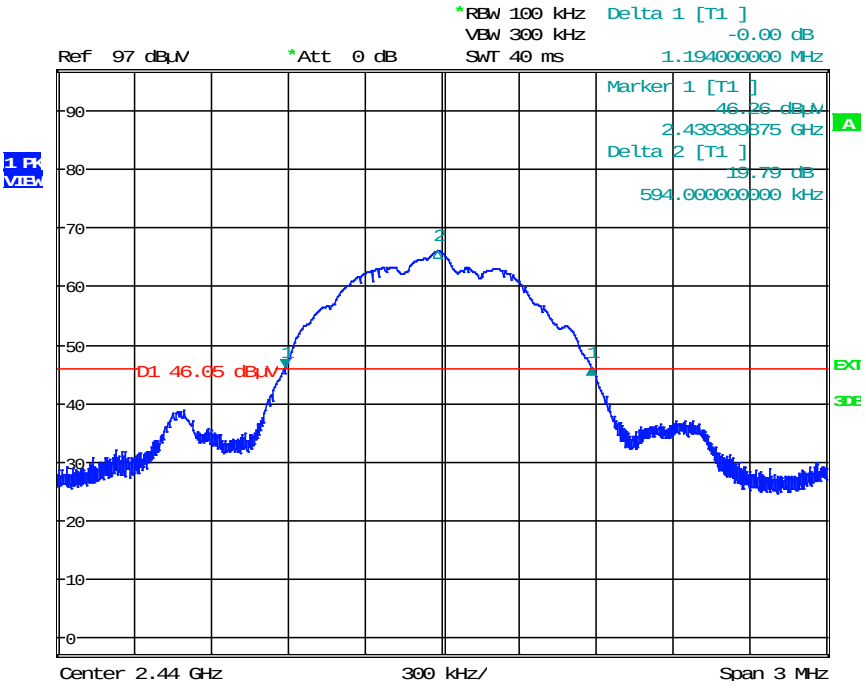


APPENDIX 5: 20dB bandwidth

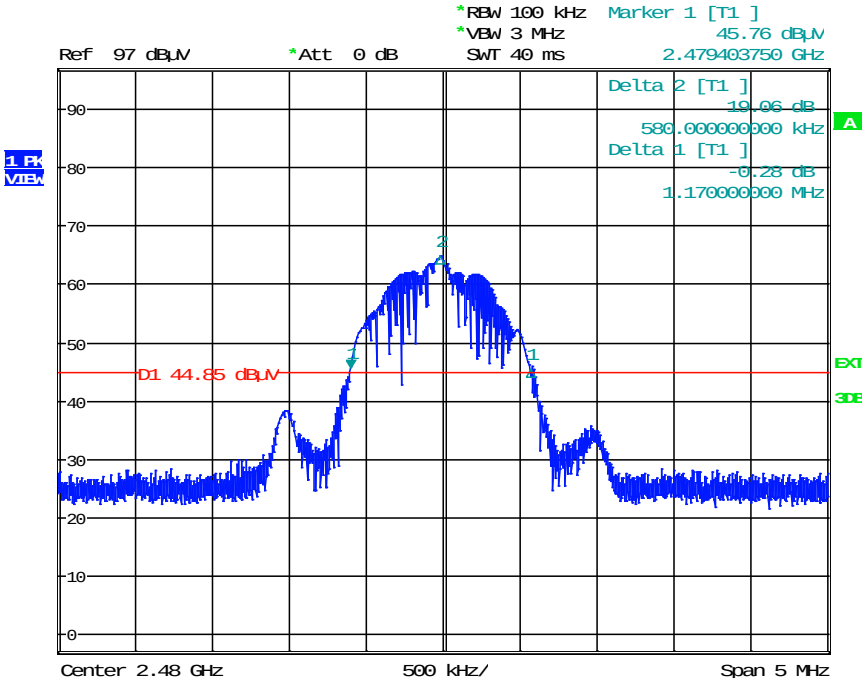
Low channel



Central channel



High channel



APPENDIX 6: Band edge