



R051-24-10-101419-2/A Ed. 1

“This report cancels and replaces the test report n° R051-24-10-101419-2/A Edition 0”

<p>RADIO test report</p> <p>according to standard: FCC Part 15</p> <p>Equipment under test: AR DRONE MYKONOS</p> <p>FCC ID: RKXMYKONOS</p> <p>Company: PARROT</p>

DISTRIBUTION: Mr LEGEAY

Company: PARROT

Number of pages: 28 including 3 annexes

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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.



PRODUCT: AR DRONE Mykonos

Reference / model: AR.Drone

Serial number: not communicated

MANUFACTURER: PARROT

COMPANY SUBMITTING THE PRODUCT:

Company: PARROT

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Responsible: Mr LEGEAY

DATE(S) OF TEST: 26 April 2010
03 and 12 May 2010

TESTING LOCATION: EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE
EMITECH ATLANTIQUE open area test site in LA POUEZE (49)
FRANCE
FCC Registration Number: 101696/FRN: 00066490 08

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1. INTRODUCTION

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

2. PRODUCT DESCRIPTION

ITU Emission code: 20M0F7D

Class: B (residential environment)

Utilization: Drone with WiFi module

Antenna type: incorporated antenna

Operating frequency range: from 2412 MHz to 2472 MHz

Number of channels: 13

Channel spacing: 5 MHz

Frequency generation: SAW Resonator Crystal Synthesizer

Modulation: Amplitude Digital Frequency Phase

Power source: Lithium polymer battery (3 cells / 11.1 V/ 1000 mAh)

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.

FCC Part 15 (2009) Code of Federal Regulations
Title 47 - Telecommunication
Chapter 1 - Federal Communications Commission
Part 15 - Radio frequency devices
Subpart C - Intentional Radiators

ANSI C63.4 (2003) Methods of Measurement of Radio-Noise Emissions from Low-voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.

1 | KDB Publication
558074 (2005) Measurement of Digital Transmission Systems Operating under Section 15.247

4. TEST METHODOLOGY

Radio performance tests procedures given in part 15:

- Paragraph 33: frequency range of radiated measurements
- Paragraph 35: measurement detector functions and bandwidths
- Paragraph 107: conducted limits
- Paragraph 109: radiated emission limits
- Paragraph 111: antenna power conducted limits for receivers
- Paragraph 203: antenna requirement
- Paragraph 205: restricted bands of operation
- Paragraph 207: conducted limits
- Paragraph 209: radiated emission limits; general requirements
- Paragraph 247: operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz and 24.0 - 24.25 GHz

5. ADD ATTACHMENTS FILES

- “Synoptic “*
- “Block diagram “*
- “External photos and Product labeling “*
- “Assembly of components “*
- “Internal photos “*
- “Layout pcb “*
- “Bil of materials “*
- “Schematics “*
- “Product description “*
- “User guide “*

6. TESTS AND CONCLUSIONS

6.1 intentional radiator (subpart C)

Test procedure	Description of test	Criteria respected ?				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 15.247	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 3
	(b) maximum peak output power	X				Note 4
	(c) operation with directional antenna gains > 6 dBi			X		Note 5
	(d) intentional radiator	X				
	(e) peak power spectral density	X				
	(f) hybrid system			X		
	(g) FHSS available channels			X		
	(h) FHSS intelligence			X		
	(i) RF exposure compliance			X		Note 6

NAp: Not Applicable

NAs: Not Asked

Note 1: incorporated antenna (see photo in annex 2).

Note 2: see FCC part 15.247 (d).

Note 3: see annex , 802.11b then 802.11g.

Note 4: conducted measurement is not possible (integral antenna), so we used the radiated method in open field.

Note 5: antenna gain = 0 dBi (declared by the applicant).

Note 6: this type of equipment uses less than 0.5 W of output power with a high signal transmitting duty factor (section 3 from Oet 65c).

6.2 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.107	CONDUCTED LIMITS			X		
FCC Part 15.109	RADIATED EMISSION LIMITS	X				
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable

NAs: Not Asked

Conclusion:

The sample of AR DRONE MYKONOS submitted to the tests complies with the regulations of the standard FCC Part 15 in accordance with the limits or criteria defined in this report.

7. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class B

Standard deviation: For $F > 1$ GHz, the measurement is carried out at 3 m, instead of 10 m

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Test receiver	Rohde & Schwarz ESVS 10	1219
Biconical antenna	Hewlett Packard 11966 C	0728
Log periodic antenna	Rohde & Schwarz HL 223	1999
Double ridged guide antenna	Electrometrics EM 6961	1204
Spectrum analyzer	Rohde & Schwarz FSP40	4088
Open area test site	EMITECH	1274
Preamplifier 1 to 18 GHz	DBS Microwave DB97-1852	2648
High pass filter	Micro-tronics HPM11630	1673
Multimeter	Fluke 77-2	0812

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

Frequency range: The highest frequency generated in the device is $f = 2472$ MHz
According the Sec.15.33 of the FCC Part 15 standard, the frequency range measured is indicated in the following table:

For unintentional radiator, including a digital device (Sec.15.33, §(b)(1) of the FCC Part 15 standard):

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

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: 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 is in standby / reception mode with its 4 engines running on.

Results:

Ambient temperature (°C): 19
Relative humidity (%): 51

Power source:

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 12.4
Voltage at the end of test (V): 12
Percentage of voltage drop during the test (%): 3.2

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
132.9	QP	207	90	120	H	26.6	43.5	16.9
150.3	QP	226	230	120	H	28.6	43.5	14.9
199.7	QP	160	340	120	H	34.8	43.5	8.7
216.2	QP	122	253	120	H	44	46	2
263.5	QP	133	0	120	H	39	46	7
468	QP	167	110	120	H	42	46	4
520	QP	167	101	120	H	39.8	46	6.2
624	QP	147	300	120	V	35.2	46	10.8
702	QP	120	142	120	H	36.5	46	9.5
780	QP	100	252	120	H	40.3	46	5.7

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

Test conclusion:

RESPECTED STANDARD

1 | 8. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247, KDB publication 558074 (2005)

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Antenna RGA60	Electrometrics	1204
Open site	EMITECH	1274
Multimeter 77-2	Fluke	0812
Meteo station	Oregon scientific	1539
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

We use for this measure outdoor test site. The measuring distance between the equipment and the test antenna is 3 m. The test antenna has been oriented in the two polarizations, we have recorded only the highest level.

A measurement of the electro-magnetic field is realized, with a calibrated peak power responding power meter.

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

Results:

Ambient temperature (°C): 19.5
 Relative humidity (%): 52

Power source:

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 12.6
 Voltage at the end of test (V): 12.2
 Percentage of voltage drop during the test (%): 4.8

Sample n° 1 **802.11b**

Minimum data rate (1 Mb/s)

Channel 1 (2412 MHz)

	Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	79.4	29.4	5.5	114.3	$80.7 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 215 cm)

Position of equipment: flat position (azimuth: 0 degree)

Channel 7 (2442 MHz)

	Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	79.6	29.4	5.5	114.5	$84.6 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 220 cm)

Position of equipment: flat position (azimuth: 0 degree)

Channel 13 (2472 MHz)

	Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	80.1	29.4	5.5	115	$94.9 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 215 cm)

Position of equipment: flat position (azimuth: 0 degree)

Maximum data rate (11 Mb/s)

Channel 1 (2412 MHz)

	Level (dBμV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	79.2	29.4	5.5	114.1	$77.1 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 215 cm)

Position of equipment: flat position (azimuth: 0 degree)

Channel 7 (2442 MHz)

	Level (dBμV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	79.7	29.4	5.5	114.6	$86.5 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 220 cm)

Position of equipment: flat position (azimuth: 0 degree)

Channel 13 (2472 MHz)

	Level (dBμV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	80.2	29.4	5.5	115.1	$97.1 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 215 cm)

Position of equipment: flat position (azimuth: 0 degree)

Sample n° 1 **802.11g**

Minimum data rate (6 Mb/s)

Channel 1 (2412 MHz)

	Level (dBμV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	79.2	29.4	5.5	114.1	$77.1 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 215 cm)

Position of equipment: flat position (azimuth: 0 degree)

Channel 7 (2442 MHz)

	Level (dBμV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	79.5	29.4	5.5	114.4	$82.6 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 220 cm)

Position of equipment: flat position (azimuth: 0 degree)

Channel 13 (2472 MHz)

	Level (dBμV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	80.2	29.4	5.5	115.1	$97.1 \cdot 10^{-3}$	1

Polarization of test antenna: vertical (height: 215 cm)

Position of equipment: flat position (azimuth: 0 degree)

Maximum data rate (54 Mb/s)

Channel 1 (2412 MHz)

	Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	79.3	29.4	5.5	114.2	78.9×10^{-3}	1

Polarization of test antenna: vertical (height: 215 cm)

Position of equipment: flat position (azimuth: 0 degree)

Channel 7 (2442 MHz)

	Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	79.4	29.4	5.5	114.3	80.7×10^{-3}	1

Polarization of test antenna: vertical (height: 220 cm)

Position of equipment: flat position (azimuth: 0 degree)

Channel 13 (2472 MHz)

	Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro- magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	80.2	29.4	5.5	115.1	97.1×10^{-3}	1

Polarization of test antenna: vertical (height: 215 cm)

Position of equipment: flat position (azimuth: 0 degree)

* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3$ m and $G_p = 1$ (declared by the applicant)

Test conclusion:

RESPECTED STANDARD

9. INTENTIONAL RADIATOR

Standard: FCC Part 15

Test procedure: paragraph 15.205
 paragraph 15.209
 paragraph 15.247

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Test receiver ESH3	Rohde & Schwarz	1058
Test receiver ESVS 10	Rohde & Schwarz	1219
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Loop antenna	EMCO	1406
Biconical antenna HP 11966C	Hewlett Packard	0728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Open site	Emitech	1274
Antenna RGA-60	Electrometrics	1204
Low-noise amplifier 2 to 18 GHz	Microwave DB	1922
High pass filter HP12/3200-5AA	Filtek	
Antenna WR42	IMC	1939
Power source E3610A	Hewlett Packard	4195
Low-noise amplifier 18 to 26 GHz	ALC	3036
Multimeter 77-2	Fluke	0812
Meteo station AB 888	Oregon scientific	1539

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

Frequency range: from 9 kHz to harmonic 10 ($F_{\text{carrier}} \leq 10 \text{ GHz}$)

Bandwidth: 120 kHz ($F < 1 \text{ GHz}$) or 100 kHz, following 15.205 or 15.247
 1 MHz ($F > 1 \text{ GHz}$) or 100 kHz, following 15.205 or 15.247

Distance of antenna: between 30 m and 3 m according the frequencies and the limits.

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

Results:

Ambient temperature (°C): 19
Relative humidity (%): 51

Power source:

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 12.4
Voltage at the end of test (V): 12
Percentage of voltage drop during the test (%): 3.2

The polarity column refers to the antenna polarity at which the maximum emissions level is measured.

Not any spurious has been detected on channels 1, 7 and 13 on both modes (802.11b and 802.11g).

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

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 99.6 dB μ V/m on channel 7 (802.11b) and 103.8 dB μ V/m on channel 7 (802.11g).
So the applicable limit is 79.6 dB μ V/m (802.11b) and 83.8 dB μ V/m (802.11g).
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

Test equipments:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Open site	Emitech	1274
Radiofrequency generator SME06	Rohde & Schwarz	1669
Antenna RGA-60	Electrometrics	1938
Antenna RGA-60	Electrometrics	1204
Multimeter 77-2	Fluke	0812

Test set up:

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

Test operating condition of the equipment:

The equipment is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 19.5
 Relative humidity (%): 52

Power source:

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 12.6
 Voltage at the end of test (V): 12
 Percentage of voltage drop during the test (%): 4.8

Sample n° 1 802.11b

Channel 1

	Peak power density at frequency: 2412 MHz
Normal test conditions	-8.6 dBm
Limits	+8 dBm

Channel 7

	Peak power density at frequency: 2442 MHz
Normal test conditions	-7.7 dBm
Limits	+8 dBm

Channel 13

	Peak power density at frequency: 2472 MHz
Normal test conditions	-9 dBm
Limits	+8 dBm

Sample n° 1 802.11g

Channel 1

	Peak power density at frequency: 2412 MHz
Normal test conditions	-8.7 dBm
Limits	+8 dBm

Channel 7

	Peak power density at frequency: 2442 MHz
Normal test conditions	-9.4 dBm
Limits	+8 dBm

Channel 13

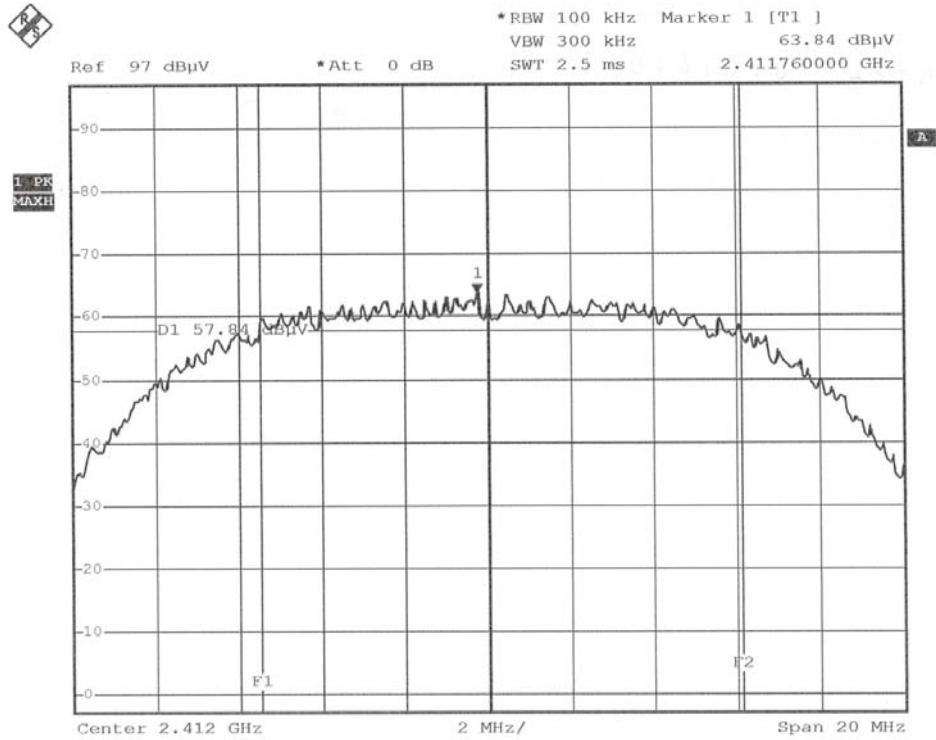
	Peak power density at frequency: 2472 MHz
Normal test conditions	-9.1 dBm
Limits	+8 dBm

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 3 annexes to be forwarded □□□

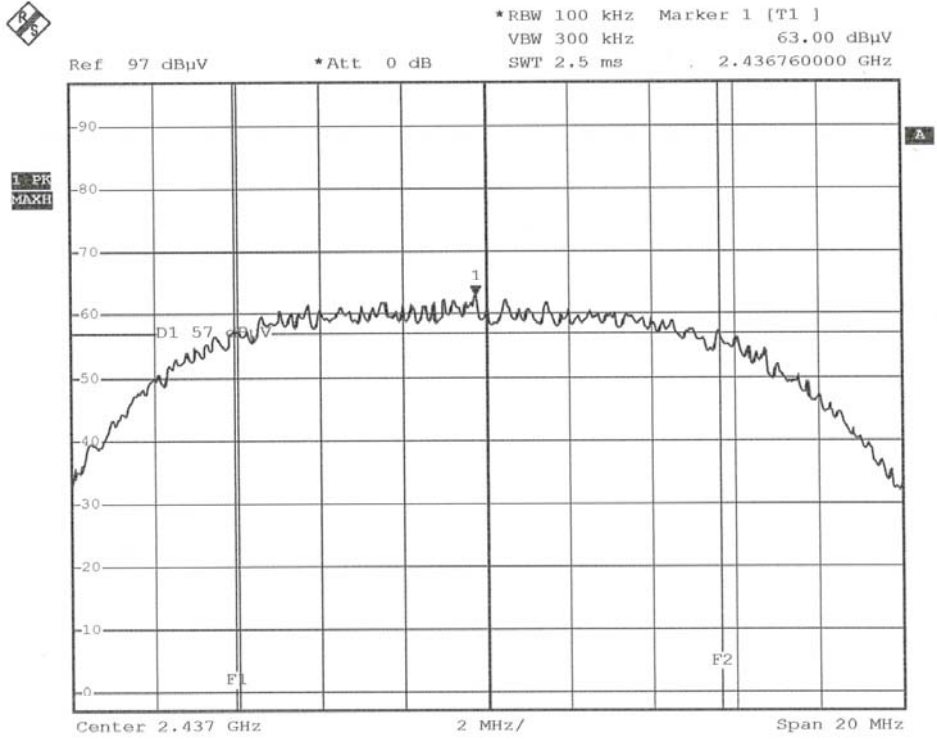
ANNEX 1: 6 dB BANDWIDTH



$F_1 = 2406,527 \text{ MHz}$

$F_2 = 2418,127 \text{ MHz}$

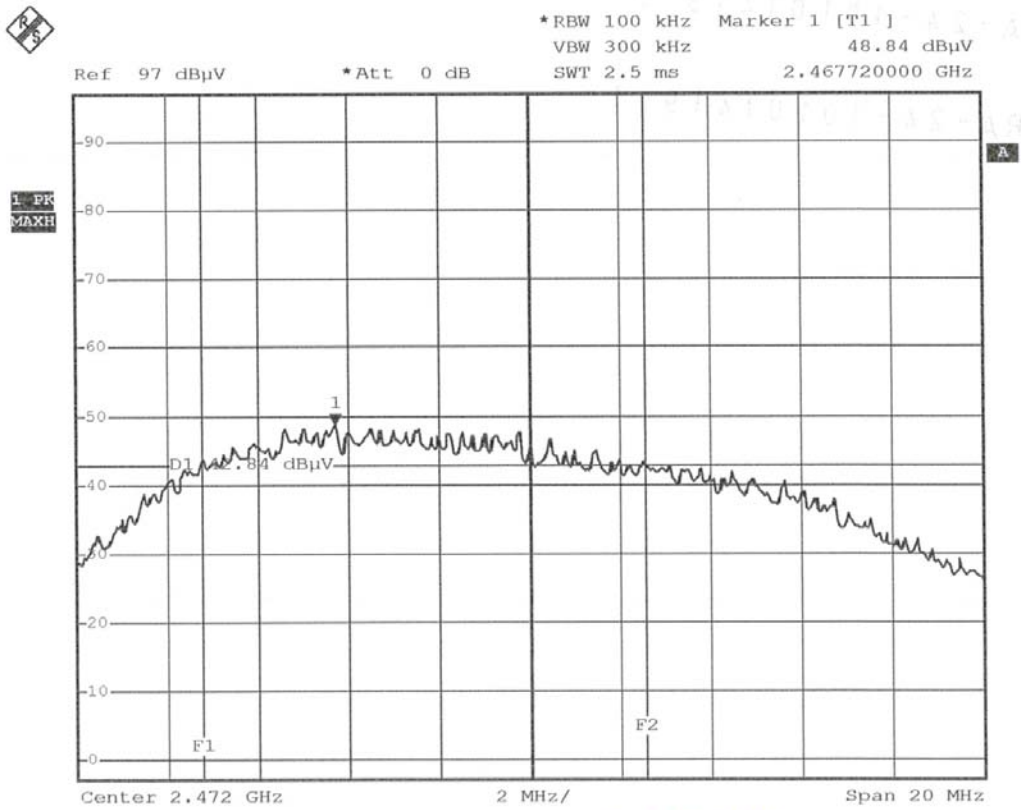
Date: 12.MAY.2010 11:23:16



$F_1 = 2430,9211\text{Hz}$.

$F_2 = 2448,6411\text{Hz}$.

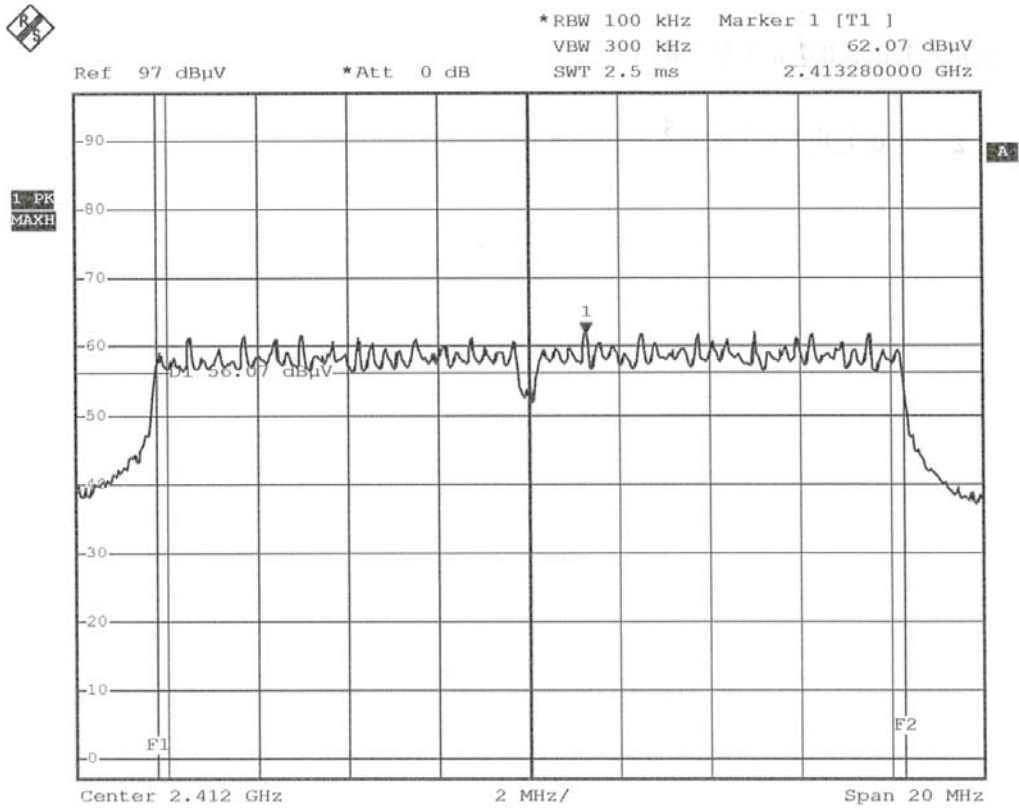
Date: 12.MAY.2010 11:28:51



$F_1 = 2464,76 \text{ MHz}$

$F_2 = 2474,56 \text{ MHz}$

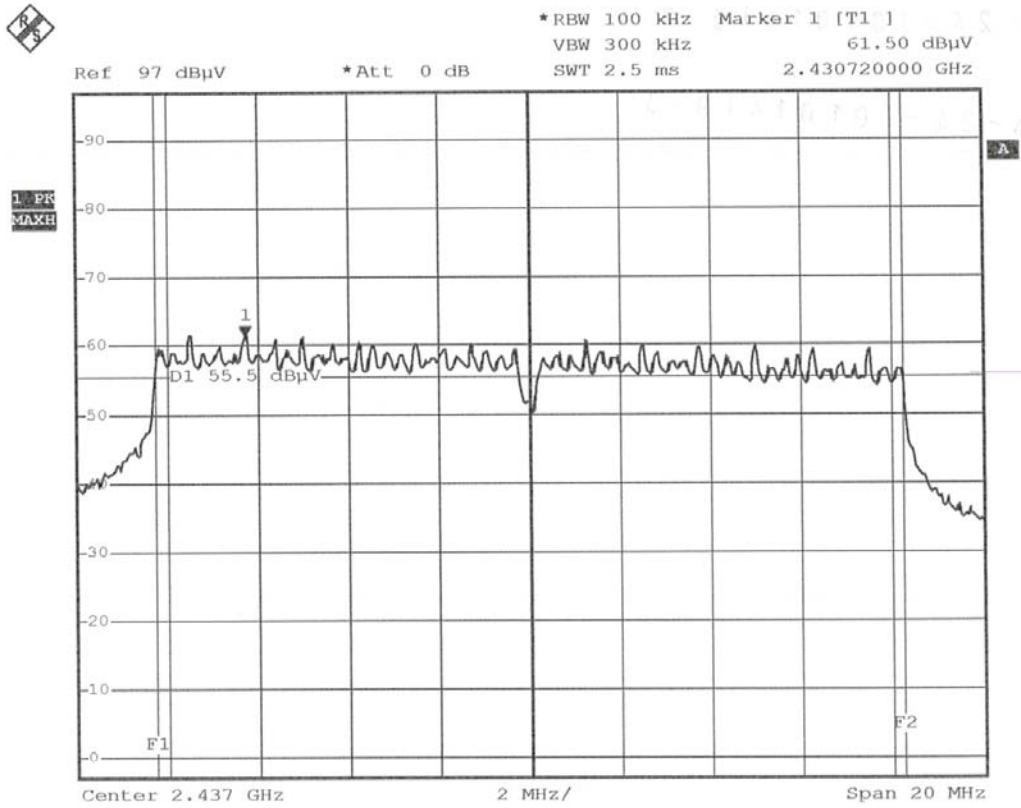
Date: 12.MAY.2010 11:32:29



F1 = 2403,7617 Hz.

2420,2817 Hz.

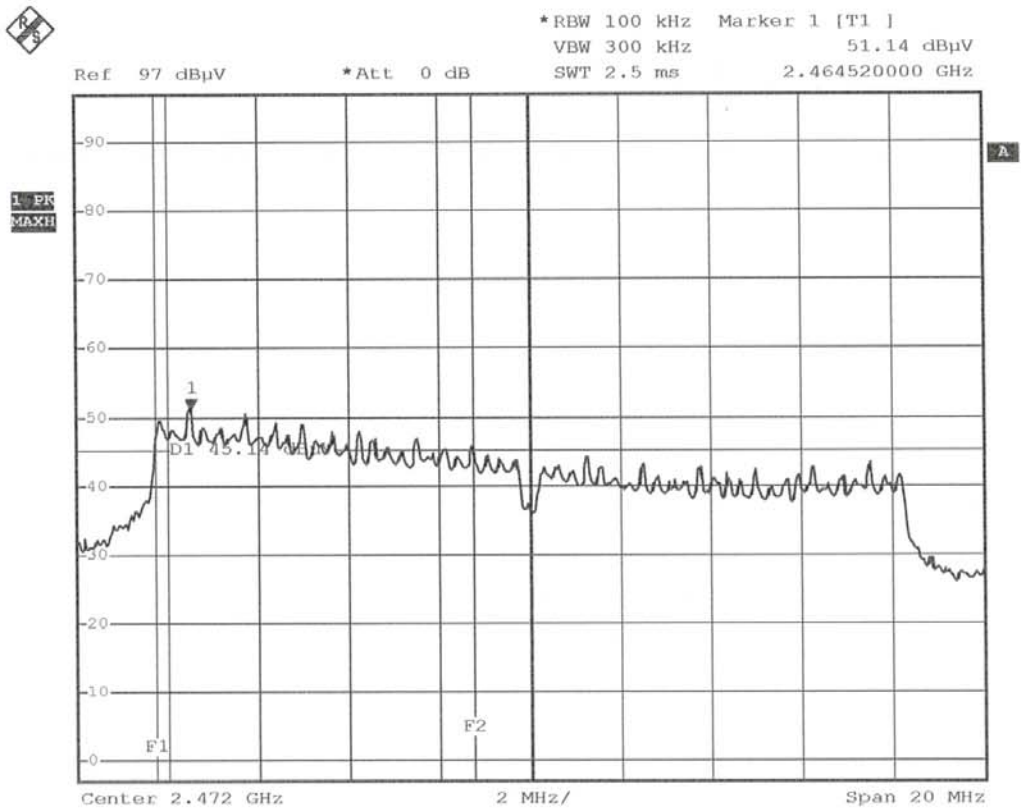
Date: 12.MAY.2010 11:43:57



$F_1 = 2428,92 \text{ MHz}$

$F_2 = 2445,24 \text{ MHz}$

Date: 12.MAY.2010 11:41:53



$F_1 = 2463,72 \text{ MHz}$

$F_2 = 2470,76 \text{ MHz}$

Date: 12.MAY.2010 11:39:57

ANNEX 2: PHOTOS OF THE EQUIPMENT UNDER TEST

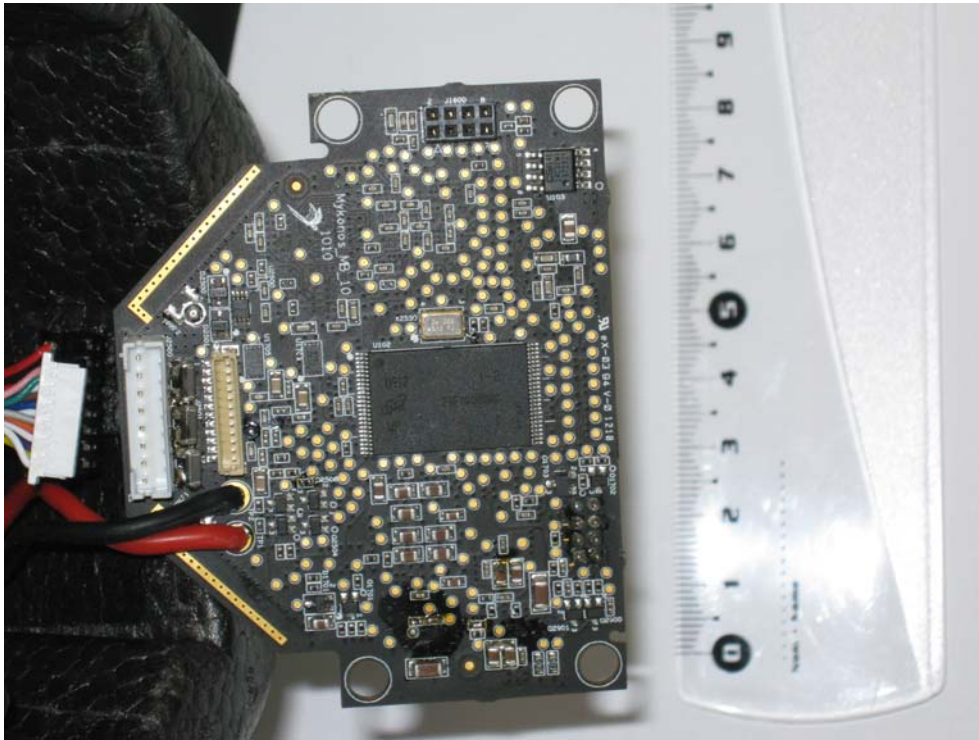
GENERAL VIEW



INTERNAL VIEW



PRINTED CIRCUIT BOARD: FACE 1



PRINTED CIRCUIT BOARD: FACE 2



ANNEX 3: TEST SET UP

RADIATED MEASUREMENTS

