



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”

RADIO test report

according to standard:
FCC Part 15

**Equipment under test:
AR DRONE MYKONOS**

FCC ID: RKXMYKONOS

**Company:
PARROT**

DISTRIBUTION: Mr LEGEAY

Company: PARROT

Number of pages: 28 including 3 annexes

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| 1 | 23-Jun-10 | 4 and 10 to 14 | L. BERTHAUD <i>LB</i> | |

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PRODUCT: AR DRONE Mykonos

Reference / model: AR.Drone

Serial number: not communicated

MANUFACTURER: PARROT

COMPANY SUBMITTING THE PRODUCT:

Company: PARROT

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

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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 | | | | <i>Note 1</i> |
| 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 | | | | <i>Note 2</i> |
| 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 | | | | <i>Note 3</i> |
| | (b) maximum peak output power | X | | | | <i>Note 4</i> |
| | (c) operation with directional antenna gains > 6 dBi | | | X | | <i>Note 5</i> |
| | (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 | | <i>Note 6</i> |

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 (dB μ V/m) | Limits (dB μ V/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 (dB μ V) | Cable loss (dB) | Antenna factor (dB) | Electro-magnetic field (dB μ V/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: 215 cm)

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

Channel 7 (2442 MHz)

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

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

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

Channel 13 (2472 MHz)

| | Level (dB μ V) | Cable loss (dB) | Antenna factor (dB) | Electro-magnetic field (dB μ V/m): | P* (W) | Limit (W) |
|-------------------------------|--------------------|-----------------|---------------------|--|-----------------------|-----------|
| Normal test conditions | 80.1 | 29.4 | 5.5 | 115 | 94.9×10^{-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 (dB μ V) | Cable loss (dB) | Antenna factor (dB) | Electro- magnetic field (dB μ V/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 (dB μ V) | Cable loss (dB) | Antenna factor (dB) | Electro- magnetic field (dB μ V/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 (dB μ V) | Cable loss (dB) | Antenna factor (dB) | Electro- magnetic field (dB μ V/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 | 77.1×10^{-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 | 82.6×10^{-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)

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)

$$* P = (E \times d)^2 / (30 \times G_p) \text{ with } d = 3 \text{ m and } G_p = 1 \text{ (declared by the applicant)}$$
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 ($F_{carrier} \leq 10$ GHz)**Bandwidth:** 120 kHz ($F < 1$ GHz) or 100 kHz, following 15.205 or 15.247
1 MHz ($F > 1$ 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

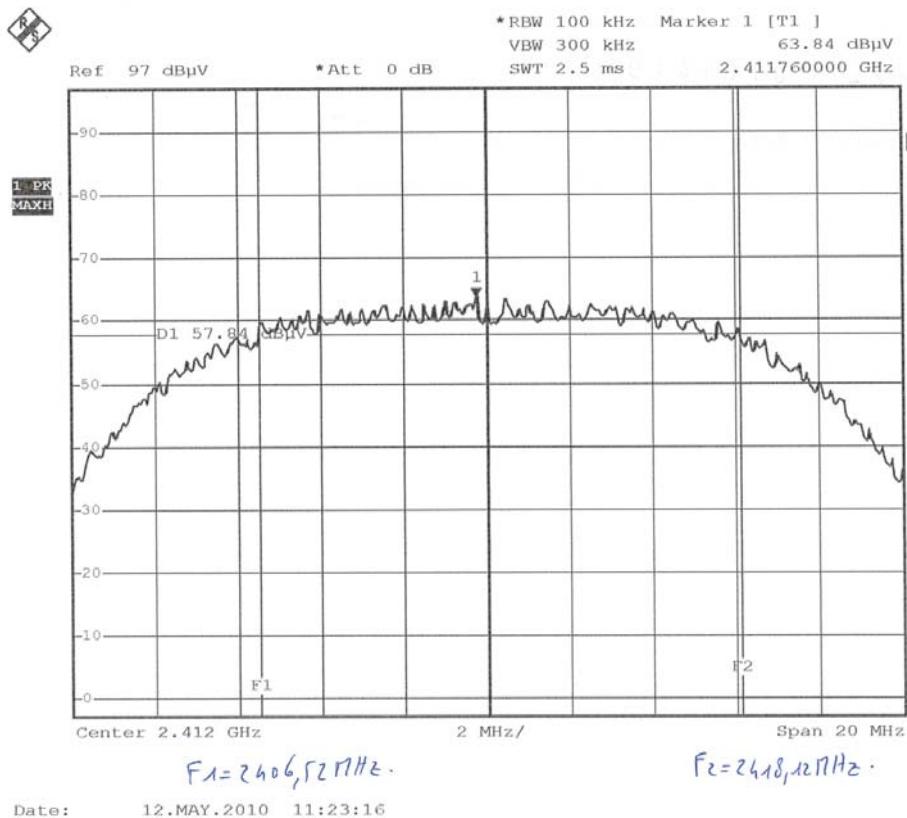
| Peak power density at frequency: 2472 MHz | |
|--|----------|
| Normal test conditions | -9.1 dBm |
| Limits | +8 dBm |

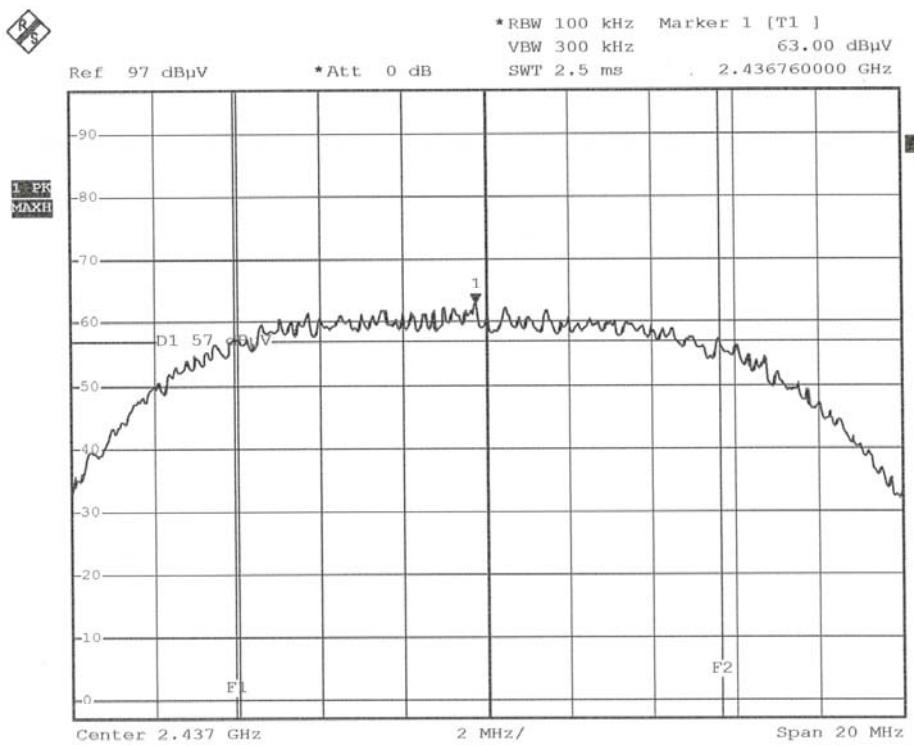
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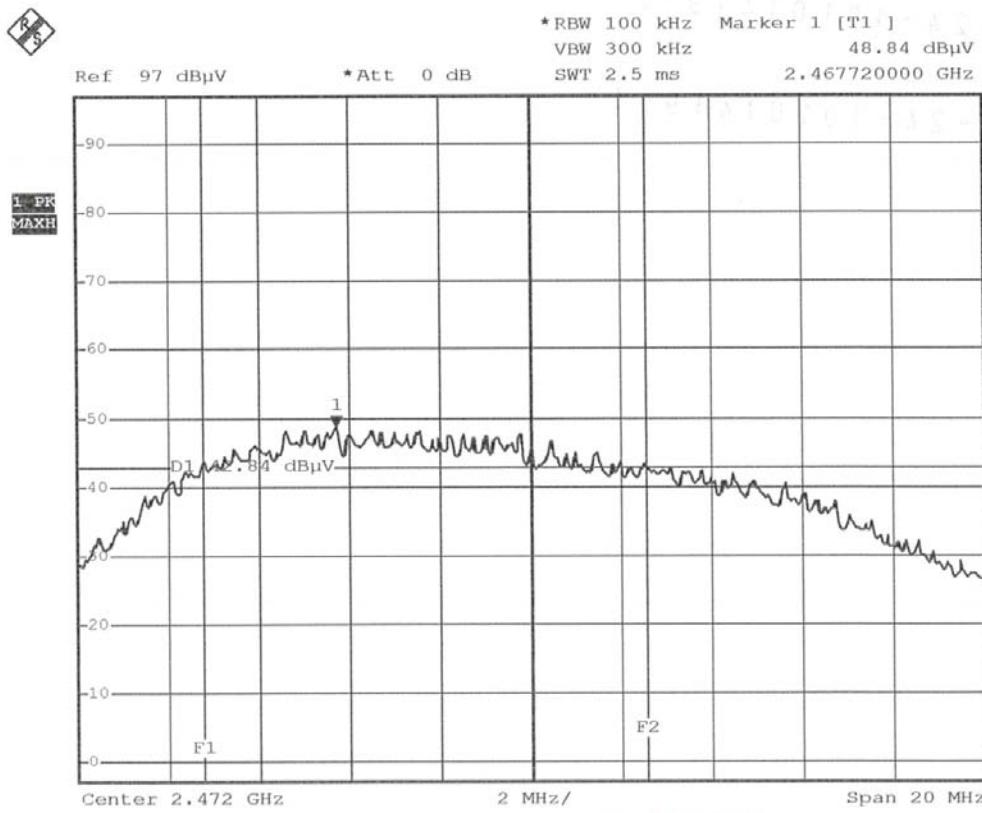
RESPECTED STANDARD

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

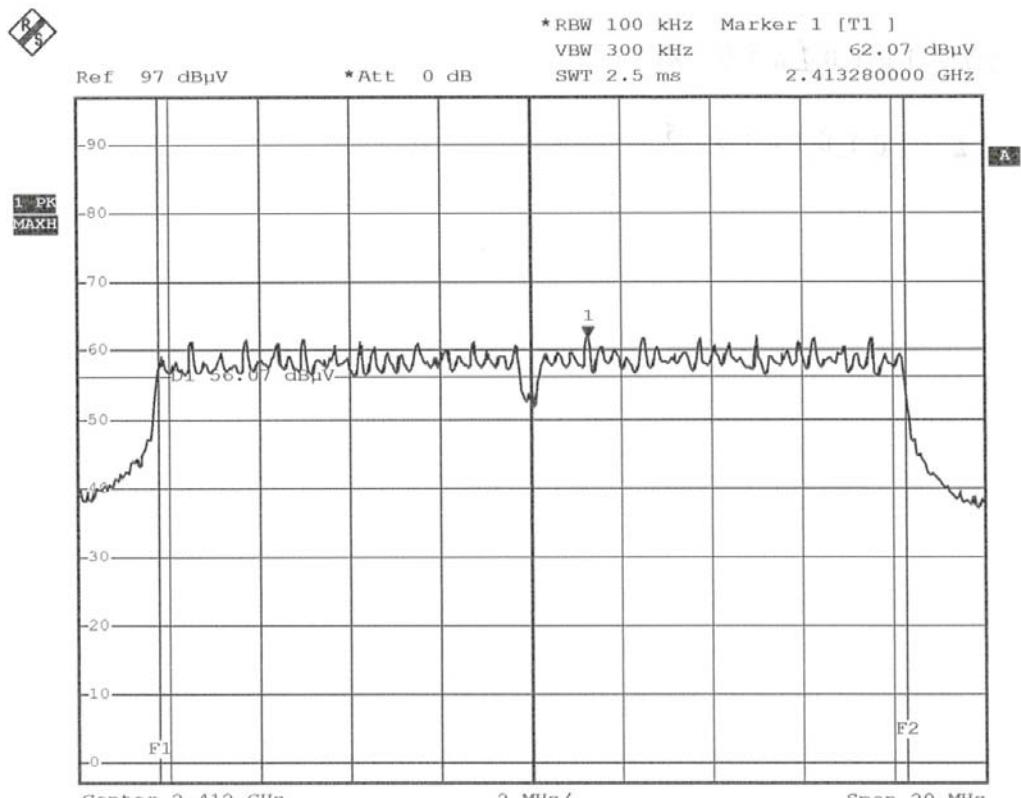
ANNEX 1: 6 dB BANDWIDTH



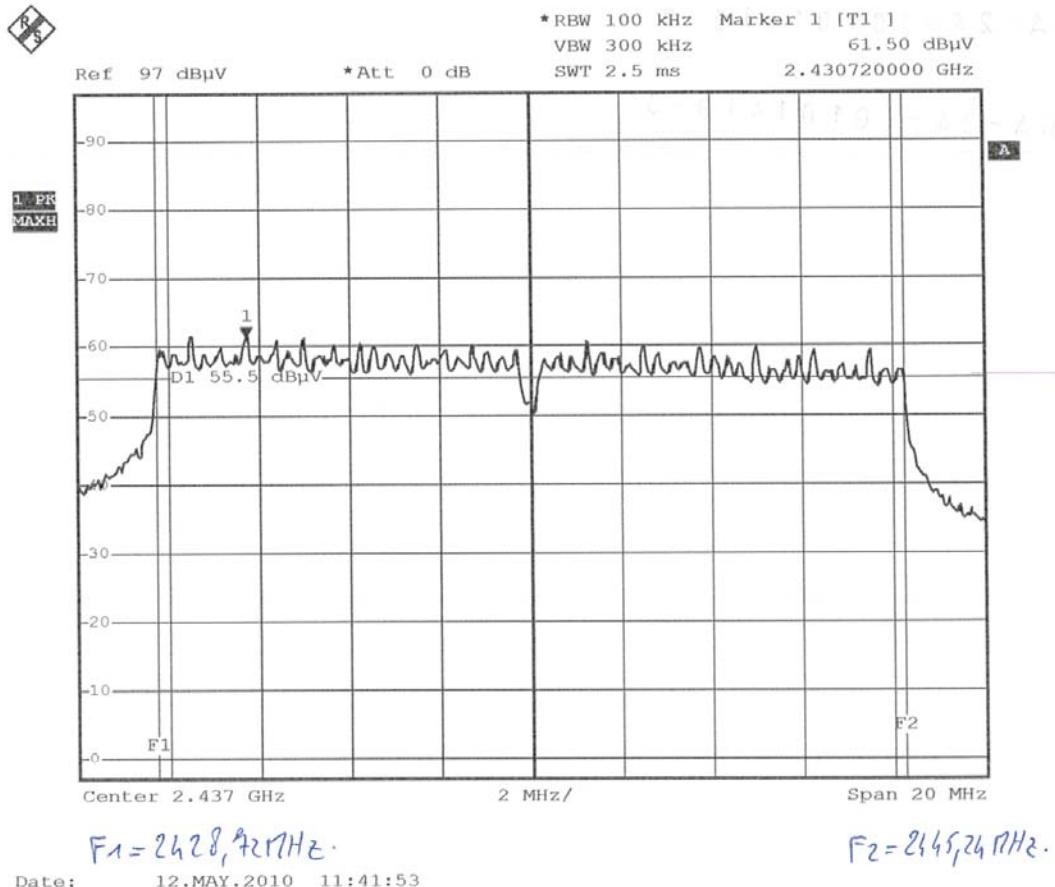


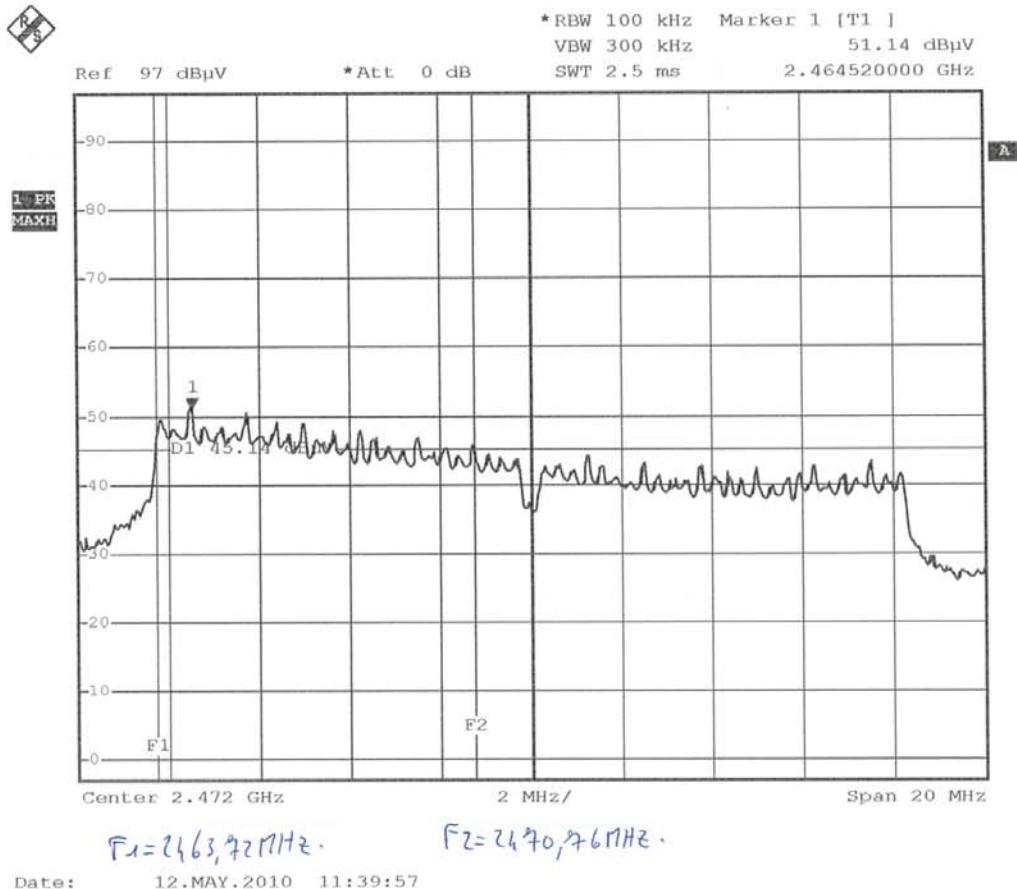


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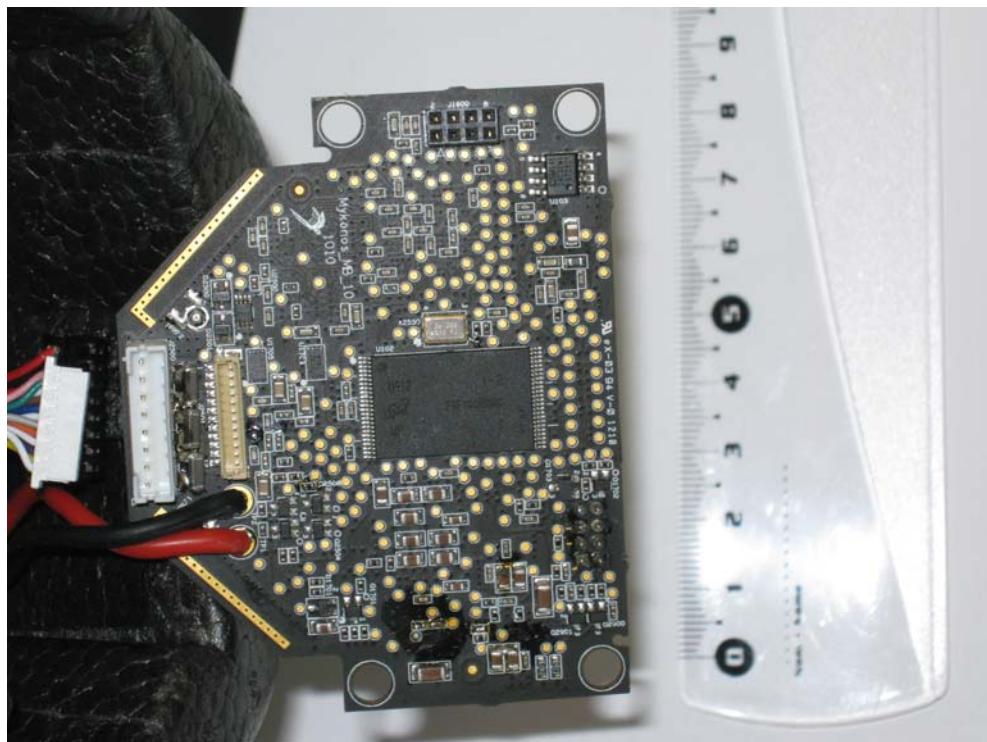


Date: 12.MAY.2010 11:43:57





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

