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RA-06-24470-1/A Ed. 0

FCC CERTIFICATION
RADIO Measurement
Technical Report

standard to apply:
FCC Part 15.247

Equipment under test:
WIFI TERMINAL I7810

FCC ID :
T8D-I7810

Company:
INGENICO

DISTRIBUTION: M. GOBION **Company: INGENICO**

Number of pages: 25 including 3 annexes

Ed.	Date	Modified pages	Editing Name / Visa	Verification Approval Name / Visa
0	1-Dec-06	Creation	L. BERTHAUD LB	P. BONNENFANT

Duplication of this test report is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.

This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.

PRODUCT:	**WIFI TERMINAL**
Reference / model:	I7810
Serial number:	not communicated
MANUFACTURER:	not communicated

COMPANY SUBMITTING THE PRODUCT:

Company:	INGENICO
Address:	10, rue du Golf Bât. M2 – Parc Innolin 33700 MERIGNAC FRANCE
Responsible:	M. GOBION
DATES OF TEST:	30 October 2006 09 November 2006
TESTING LOCATION:	EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE EMITECH ATLANTIQUE open area test site in LA POUEZE (49) FRANCE Registration Number by FCC: 101696/FRN: 0006 6490 08
TESTED BY:	L. BERTHAUD

CONTENTS

TITLE **PAGE**

1.INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: WIFI TERMINAL I7810 in accordance with normative reference.

2.PRODUCT DESCRIPTION

ITU Emission code: 13M0G7D

Class: A (commercial, industrial or business environment)

Utilization: payment terminal

Antenna type: incorporated antenna

Operating frequency range: I.S.M. band from 2400 MHz to 2483.5 MHz

Number of channels: 11

Channel spacing: 5 MHz

Frequency generation: O SAW Resonator O Crystal ⊙ Synthetiser

Modulation: Direct sequence spread spectrum
O Amplitude ⊙ Digital O Frequency O Phase

Power source: Li-Ion battery (1 × 7.4 V)

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

FCC Part 15 (2006)	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

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 205: restricted bands of operation
Paragraph 209: radiated emission limits; general requirements
Paragraph 247: operation within the bands 2400-2483.5 MHz

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

Test procedure	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				*Note 7*
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS			X		*Note 3*
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				*Note 4*
FCC Part 15.247	OPERATION WITHIN THE BAND 2400-2483.5 MHz					
	(a) (1) *hopping systems*			X		
	(a) (2) *digital modulation techniques*	X				*Note 1*
	(b) *max output power*	X				*Note 5*
	(c) *operation with directional antenna gains > 6 dBi*			X		*Note 2*
	(d) *intentional radiator*	X				
	(e) *peak power spectral density*	X				
	(f) *hybrid system*			X		
	(g)			X		
	(h)			X		
	(i) *RF exposure compliance*	X				*Note 6*
	BAND EDGE COMPLIANCE	X				

NAp: Not Applicable NAs: Not Asked

Note 1: the minimum 6 dB bandwidth is at least 500 kHz (see annex 1).

Note 2: the antenna gain is less than 6 dBi.

Note 3: battery source power.

Note 4: see FCC part 15.247 (d).

Note 5: conducted measurement is not possible (integral antenna), so we used radiated method, with a calibrated RF power meter.

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).

Note 7: incorporated PCB antenna (see photos in annex 2).

Conclusion:

The sample of WIFI TERMINAL I7810 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.PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Antenna RGA60	Electrometrics	1938
Antenna RGA60	Electrometrics	1204
Open site	EMITECH	1274
Radio frequency generator SME06	Rohde & Schwarz	1669
High pass filter HPM11630	Micro-tronics	1673
Low-noise amplifier 1 to 18 GHz	ALC	2648
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Multimeter 77-2	Fluke	812

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, by substitution method. The measuring distance between the equipment and the test antenna is 3 m. The antenna have been oriented in the two polarizations, we have recorded only highest level.

In first the spectrum analyzer is replaced by a calibrated wideband power meter and the level is recorded.
The equipment under test is then substituted by a signal generator with a calibrated double ridged guide antenna, and its level adjusted to obtain the same power level as the E.U.T.
The output power level of the signal generator is finally measured with a calibrated RF 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 is blocked in continuous transmission mode (T, the transmission pulse duration is locked at 100 %), modulated by internal data signal.

Results:

Ambient temperature (°C): 17
Relative humidity (%): 53

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

Voltage at the beginning of the test (V): 8.15
Voltage at the end of the test (V): 7.98
Percentage of voltage drop during the test (%): -2.1

Sample n° 1 Channel 1 (2412 MHz)

	Level (dBµV)	**Cable loss (dB)**	**Antenna factor (dB)**	**Electromagnetic field (dBµV/m)**	**P* (W)**
Normal test conditions	80.70	4.41	27.77	112.88	58.22×10^{-3}

Sample n° 1 Channel 7 (2442 MHz)

	Level (dBµV)	**Cable loss (dB)**	**Antenna factor (dB)**	**Electromagnetic field (dBµV/m)**	**P* (W)**
Normal test conditions	81.33	4.41	27.77	113.51	67.32×10^{-3}

Sample n° 1 Channel 11 (2462 MHz)

	Level (dBµV)	**Cable loss (dB)**	**Antenna factor (dB)**	**Electromagnetic field (dBµV/m)**	**P* (W)**
Normal test conditions	80.98	4.41	27.77	113.16	62.10×10^{-3}

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

Test conclusion:

RESPECTED STANDARD

8.PEAK POWER DENSITY

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipment used:

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
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Multimeter 77-2	Fluke	812

Measured condition:

We used the same method of the peak output power measurement but the E.U.T. 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): 17
Relative humidity (%): 53

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

Voltage at the beginning of the test (V): 8.15
Voltage at the end of the test (V): 7.98
Percentage of voltage drop during the test (%): -2.1

Sample n° 1 Channel 1

	Peak power density at frequency: 2412 MHz
Normal test conditions	-15.1 dBm
Limits	+8 dBm

Sample n° 1 Channel 7

	Peak power density at frequency: 2442 MHz
Normal test conditions	-17.14 dBm
Limits	+8 dBm

Sample n° 1 Channel 11

	Peak power density at frequency: 2462 MHz
Normal test conditions	-16.39 dBm
Limits	+8 dBm

Test conclusion:

RESPECTED STANDARD

9.RADIATED EMISSION OF TRANSMITTER

Standard: FCC Part 15

Test procedure: paragraph 15.205
paragraph 15.209
paragraph 15.247

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Test receiver ESH3	Rohde & Schwarz	1058
Test receiver ESVS 10	Rohde & Schwarz	1219
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Loop antenna	EMCO	1406
Biconical antenna HP 11966C	Hewlett Packard	728
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
Low-noise amplifier 18 to 26 GHz	ALC	3036
Multimeter 77-2	Fluke	812

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)

Detection mode: Quasi-peak (F < 1 GHz)
Average (F > 1 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

Equipment under test operating condition:

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

Results:

Ambient temperature (°C): 16.5
Relative humidity (%): 43

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

Voltage at the beginning of the test (V): 8.23
Voltage at the end of the test (V): 8.07
Percentage of voltage drop during the test (%): -1.9

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

Channel 1

FREQUENCIES (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4823.9	Avg	239	11	1000	V	53.15	54*	0.88
4823.9	Peak	239	11	1000	V	57.19	74	16.81

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section.

Channel 7

FREQUENCIES (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4884	Avg	150	19	1000	V	53.53	54*	0.47
4884	Peak	150	19	1000	V	57.57	74	16.43

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section.

Channel 11

FREQUENCIES (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4943.9	Avg	144	03	1000	V	53.72	54*	0.28
4943.9	Peak	144	03	1000	V	57.76	74	16.24

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section.

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 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 99.01 dBµV/m on channel 11, so the applicable limit is **79.01 dBµV/m**.
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205 (a), must also comply with the radiated emission limit specified in Section 15.209 (a) (see Section 15.205 (a)).

TEST CONCLUSION:

RESPECTED STANDARD

10.BAND EDGE COMPLIANCE

Standard: FCC Part 15.247

Test procedure: Public Notice DA 00-705, Delta Marker method

Test equipment used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Antenna RGA-60	Electrometrics	1204

Measured condition:

Requirements: Emissions that fall in the restricted bands (part 15.205). These emissions must be less than or equal to 500 µV/m (54 dBµV/m)/ Part 15.35b applies in the restricted bands.

Test procedure: An in band field strength measurement of the fundamental Emission using the RBw and detector function required by C63.4-2003 and FCC Rules.

Test operating condition of the equipment:

The equipment is blocked in continuous modulated transmission mode.

Results:

Lower Band Edge: from 2310 MHz to 2390 MHz (CURVE n° 1 and CURVE n° 2)
Upper Band Edge: from 2483.5 MHz to 2500 MHz (CURVE n° 3 and CURVE n° 4)

Sample n°1:

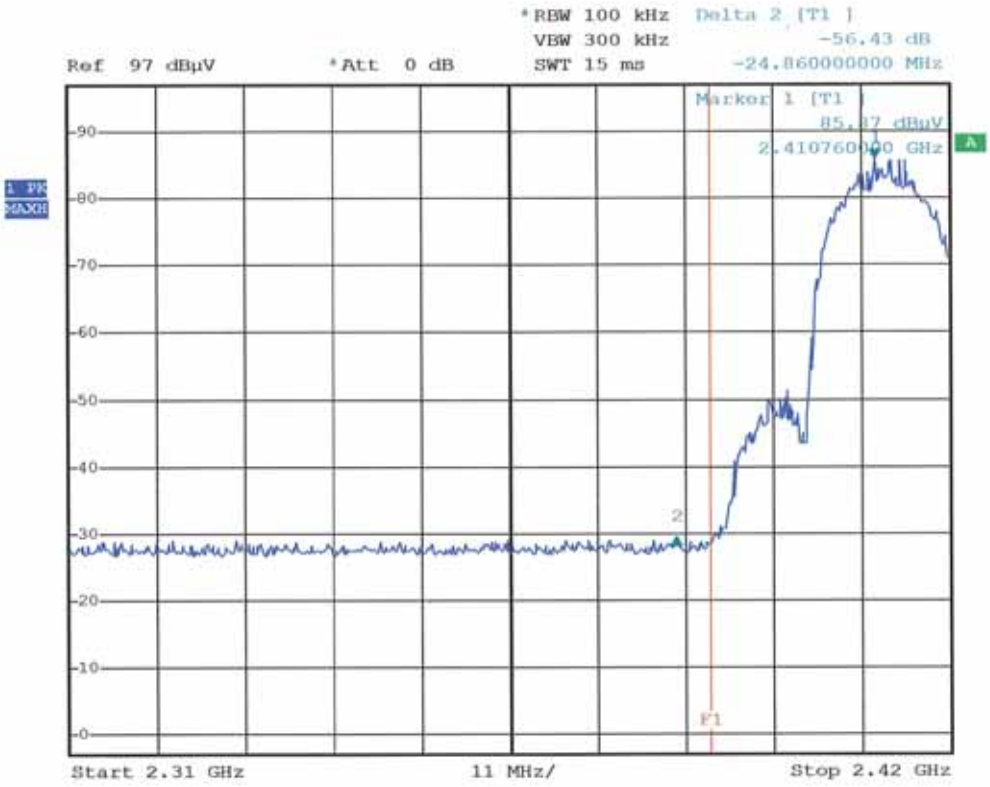
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Peak or Average	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out of Band Emission Level (dBµV/m)**	Limit (dBµV/m)	Margin (dB)
2412	116	Peak	2385.9	-56.43	59.57	74	14.43
2412	107.5	Average	2374.24	-56.75	50.75	54	3.25
2462	115.6	Peak	2483.6	-53.39	62.21	74	11.79
2462	107.2	Average	2483.9	-56.83	50.37	54	3.63

* according to step 2 of Marker-Delta Method DA 00-705.
** according to step 3 of Marker-Delta Method:
Calculated Emission Level = Field Strength Level – Delta Marker Level

Test conclusion:

RESPECTED PUBLIC NOTICE

CURVE N° 1.



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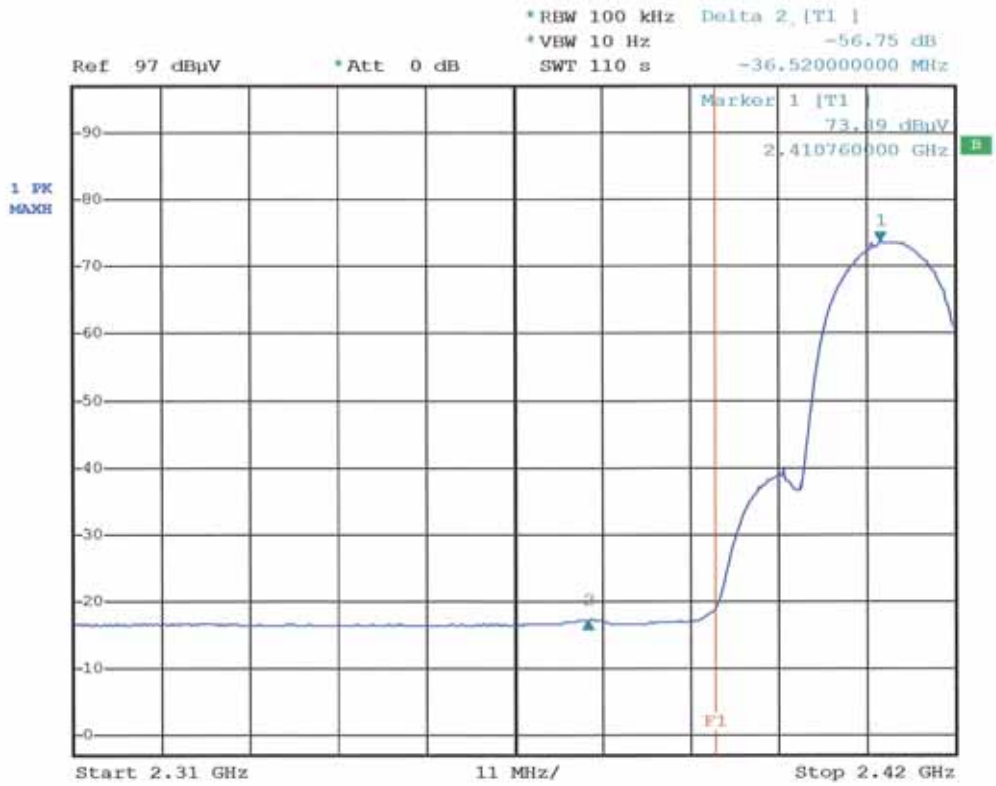
CURVE N° 2.



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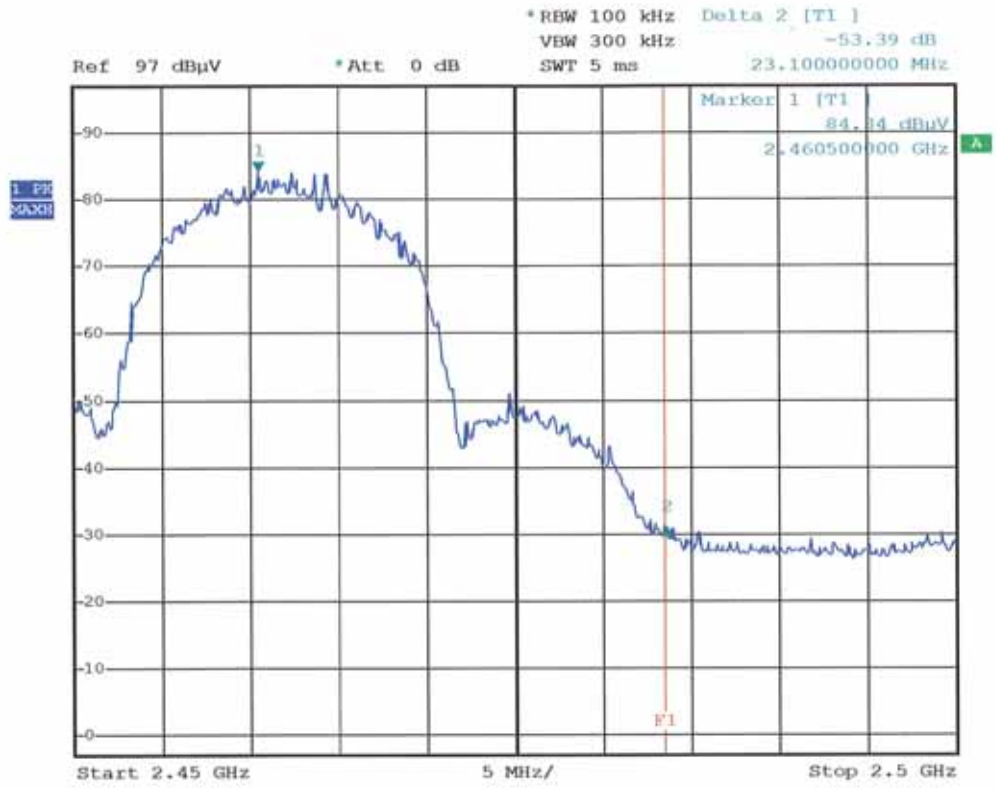
CURVE N° 3.



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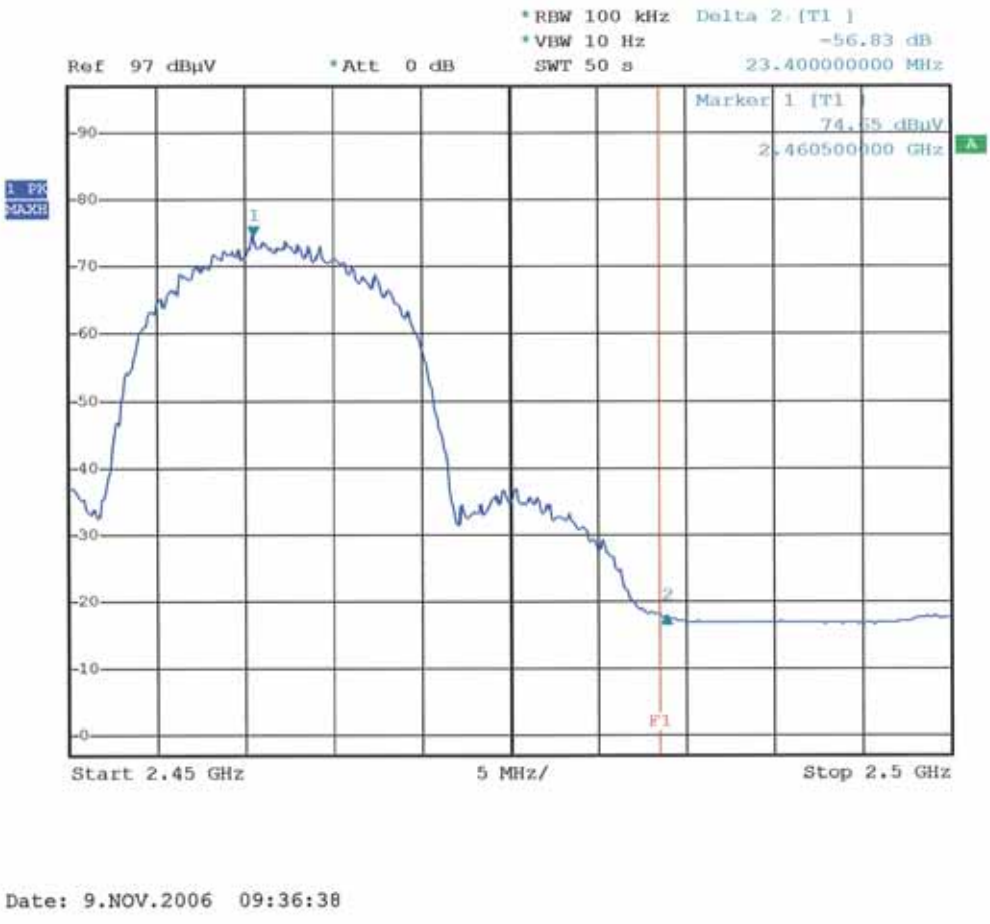
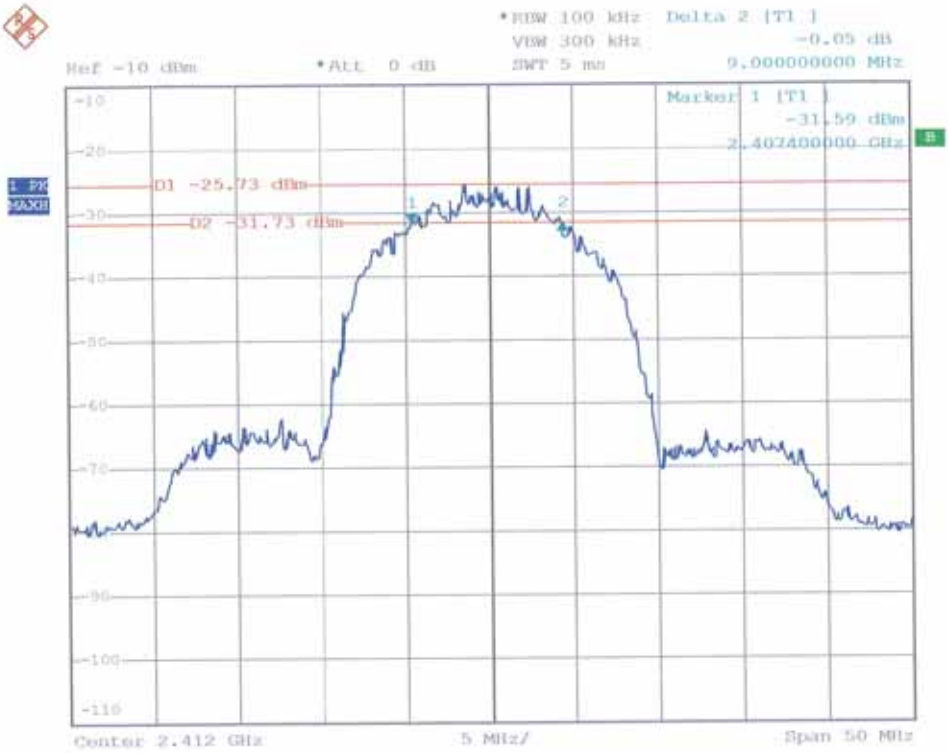
CURVE N° 4.



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

ANNEX 1: MINIMUM 6 DB BANDWIDTH



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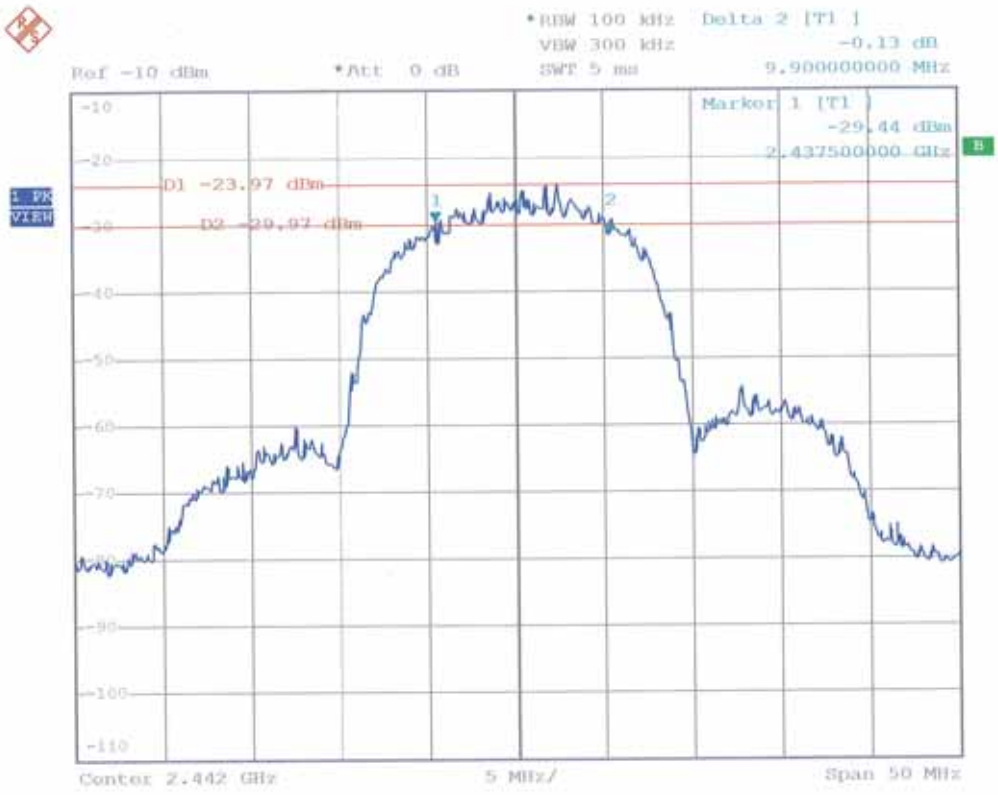

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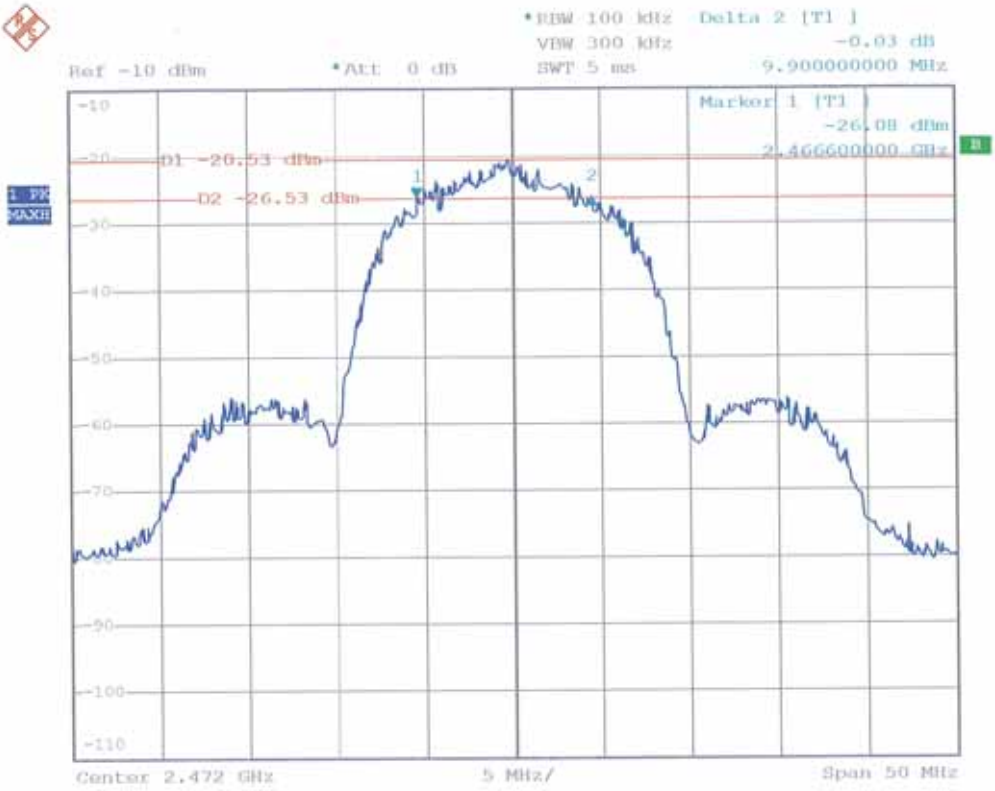

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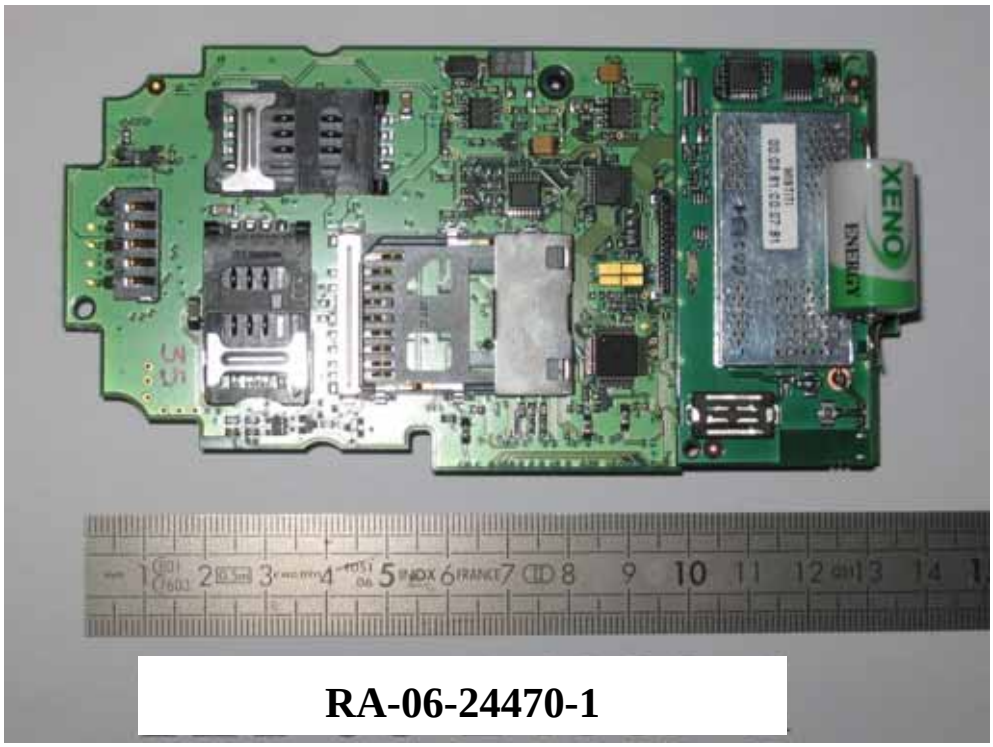
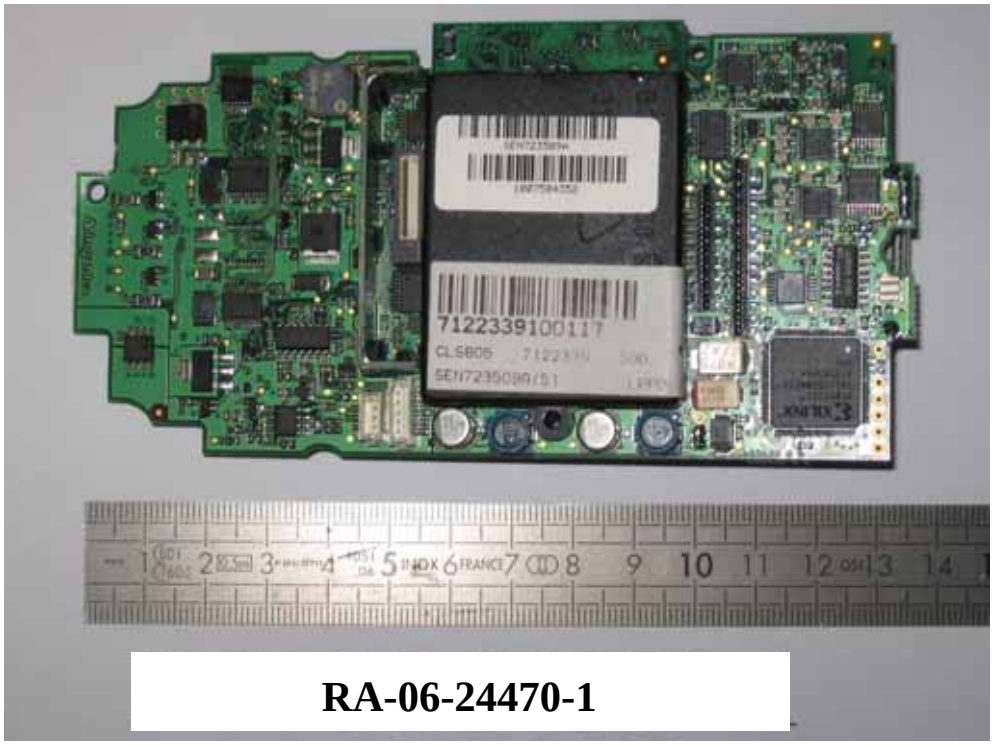
ANNEX 2: PHOTOS OF THE EQUIPMENT UNDER TEST

GENERAL VIEW

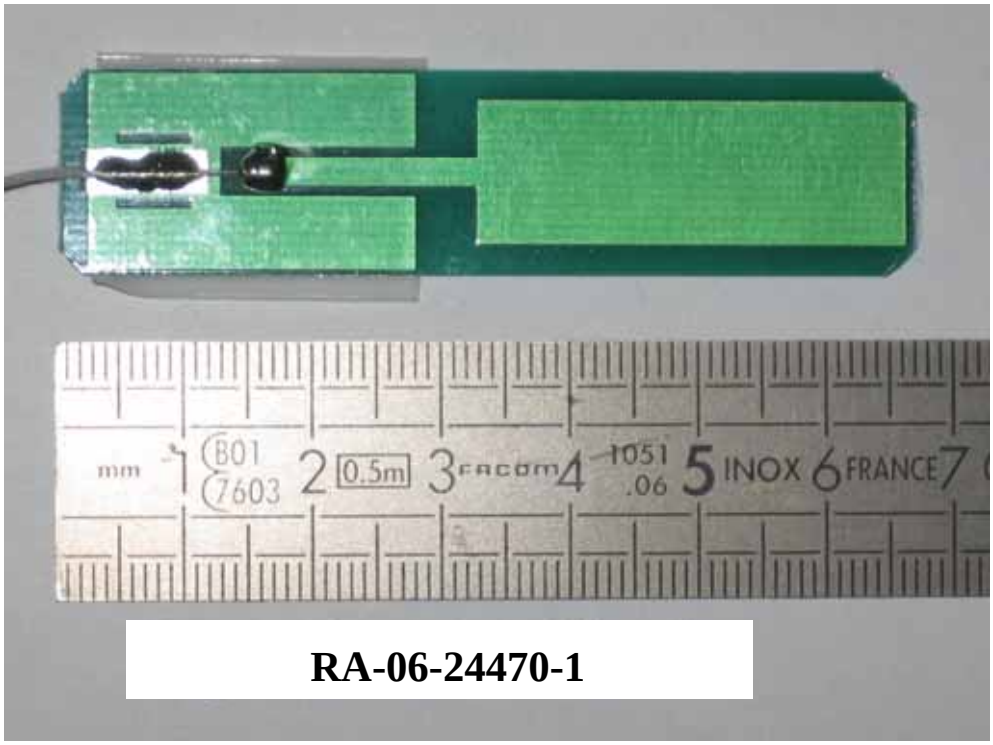
Printed circuit: face 1



Printed circuit: face 2



Antenna



ANNEX 3: TEST SET UP

OPEN AREA TEST SITE

Test set up radiated measurement