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RA-06-24579-1/A Ed 0

FCC CERTIFICATION RADIO Measurement Technical Report

standard to apply:
FCC Part 15.247

Equipment under test:
Bluetooth Base VBASE A
I7780

FCC ID :
T8D-VBASE

Company:
INGENICO

DISTRIBUTION: M. GOBION

Company: INGENICO

Number of pages: 42 including 5 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.

SIEGE SOCIAL : EMITECH S.A.

PRODUCT: Bluetooth Base VBASE A

Reference / model: I7780

Serial number: not communicated

MANUFACTURER: not communicated

COMPANY SUBMITTING THE PRODUCT:

Company: INGENICO

Address: 10, rue du Golf
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Responsible: M. GOBION

DATES OF TEST: 15, 20 and 21 December 2006
04 and 09 January 2007

TESTING LOCATION: EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE
EMITECH ATLANTIQUE open area test site in LA POUZEZE (49)
FRANCE

Registration Number by FCC: 101696/FRN: 0006 6490 08

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1.INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: Bluetooth Base VBASE A I7780 in accordance with normative reference.

2.PRODUCT DESCRIPTION

ITU Emission code:	1M00F7D
Class:	A (commercial, industrial or business environment)
Utilization:	payment base with Bluetooth functions
Antenna type:	incorporated antenna
Operating frequency range:	from 2402 MHz to 2480 MHz
Number of channels:	79
Channel spacing:	1MHz
Frequency generation:	Synthesizer
Modulation: Frequency Hopping Spread Spectrum (FHSS)	Frequency
Power source:	115 V.a.c. (mains)

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 (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.
Public Notice DA 00-705	Filing and Measurement Guideline for Frequency Hopping Spread Spectrum Systems.

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 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 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				
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) <i>hopping systems</i>	X				Note 1
	(a) (1) (i) 902 – 928 MHz			X		
	(a) (1) (ii) 5725 – 5850 MHz			X		
	(a) (1) (iii) 2400 – 2483.5 MHz	X				Note 2
	(a) (2) <i>digital modulation techniques</i>			X		
	(b) <i>max output power</i>	X				Note 5
	(c) <i>operation with directional antenna gains > 6 dBi</i>			X		Note 3
	(d) <i>intentional radiator</i>	X				
	(e) <i>peak power spectral density</i>			X		
	(f) <i>hybrid system</i>			X		
	(g)			X		
	(h)	X				
	(i) <i>RF exposure compliance</i>	X				Note 6
	BAND EDGE COMPLIANCE	X				

NAp: Not Applicable

NAs: Not Asked

Note 1: *the frequency hopping system have hopping channel carrier frequencies separated by 1 MHz. The system hop 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 of 20 dB bandwidth of the hopping channel (see annex 1).*

Note 2: *the frequency hopping system use more than 15 channels.*

The timing by channel is 422.4 μ s. During 79 channels \times 0.4 s (part 15) = 31.6 s, any channel is used 328 times, then 328 \times 422.4 μ s = 138.55 ms, thus the average time of occupancy on any channel is less than 400 ms within a period of 0.4 s multiplied by the number of hopping channels employed, in normal operating mode (see annex 2).

Note 3: *the antenna gain is less than 6 dBi.*

Note 4: *see FCC part 15.247 (d).*

Note 5: *conducted measurement is not possible (integral antenna), so we used the radiated method in open field.*

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: *internal antenna (pcb antenna), see annex 3.*

Conclusion:

The sample of Bluetooth Base VBASE A I7780 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.MEASUREMENT OF THE CONDUCTED DISTURBANCES**Standard:** FCC Part 15**Test procedure:** Paragraph 15.207**Limits:** Class B**Test equipment:**

TYPE	BRAND	EMITECH NUMBER
Test receiver ESH3	Rohde & Schwarz	1058
Pulse limiter ESH3-Z2	Rohde & Schwarz	0976
Artificial main network	Schwartzbeck	2277
Spectrum analyzer HP8594E	Hewlett packard	1030
AC power supply PCR4000L	Kikusui	3132

Software used: BAT-EMC V3.1.7.1**Test set up:**

The test unit is placed on a wooden table, 0.8 m over an 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.

Equipment under test operating condition:

The equipment is powered with the AC power operating voltage of 115 V / 60 Hz and blocked in continuous modulated transmission mode (frequency hopping) during the test.

Frequency range: 150 kHz - 30 MHz**Detection mode:** Peak / Average**Bandwidth:** 9 kHz**Results:****Measurement on the mains power supply:**

The measurement is made with peak detector.

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

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

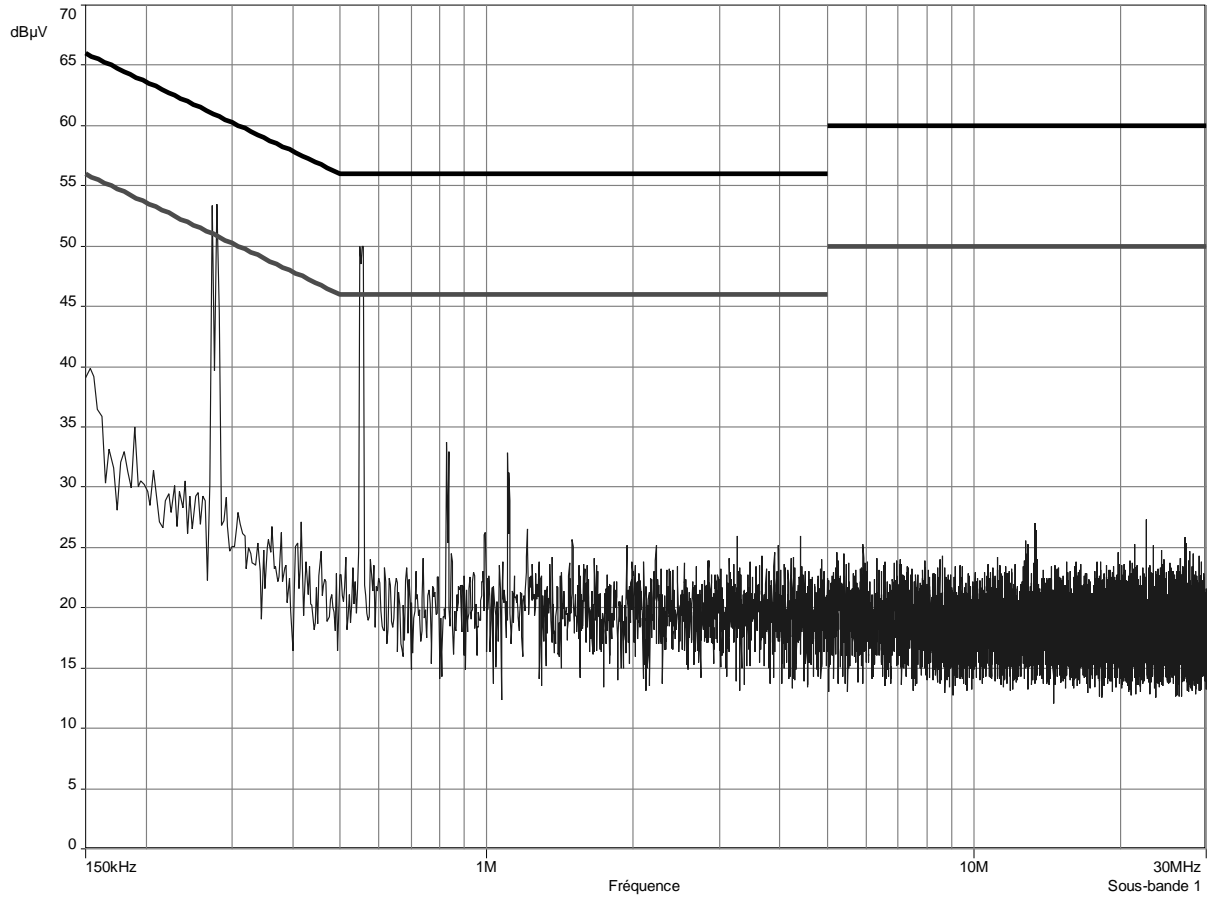
The spectrum line which are less than 6 dB of the limit are then analyzed with Average detector.

Curve N° 3: measurement on the Neutral with average detector, from 150 kHz to 700 kHz.

Curve N° 4: measurement on the Line with average detector, from 150 kHz to 700 kHz.

CURVE N°: 1.

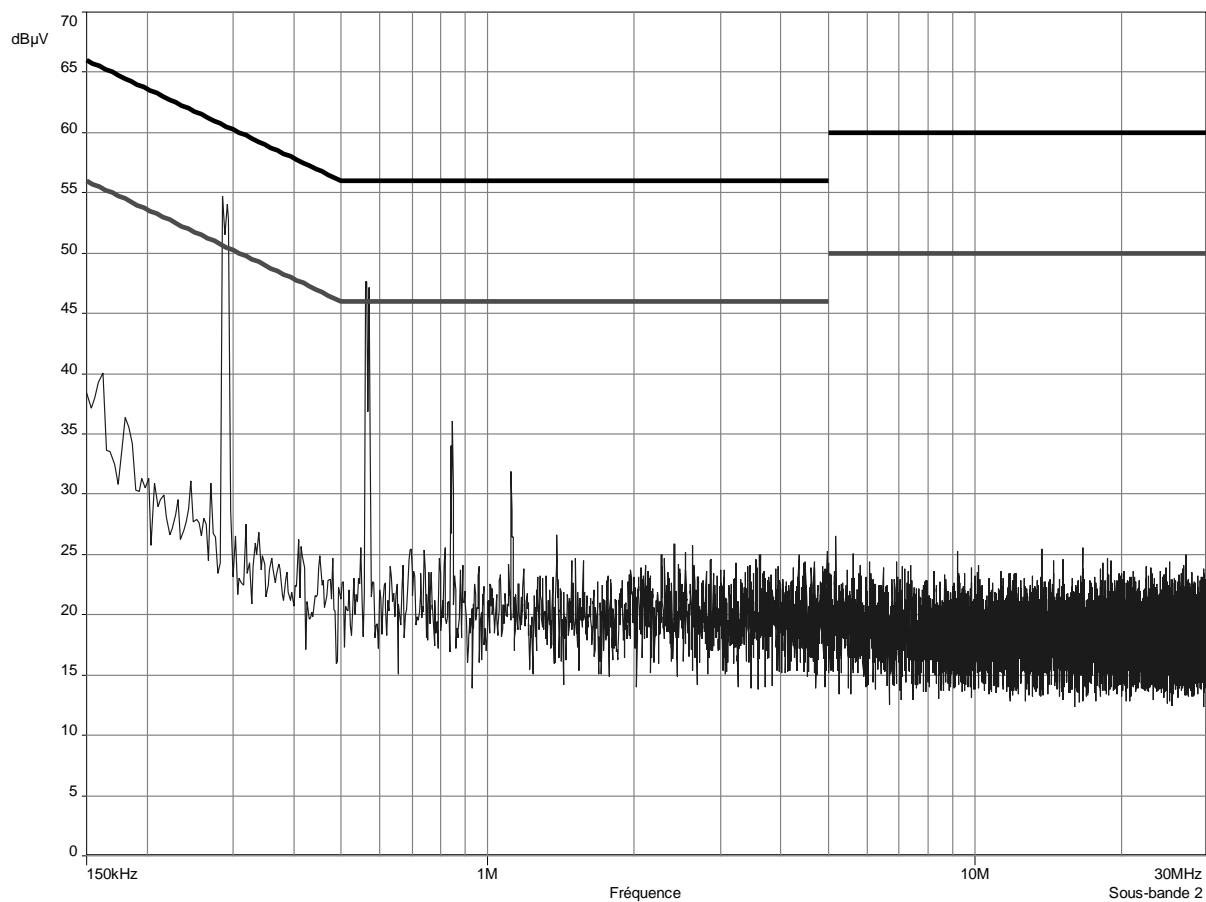
Measurement on the neutral with peak detector



RBW filter: 10 kHz
 VBW filter: 10 kHz
 Sweep time: 500 ms/MHz

CURVE N°: 2.

Measurement on the line with peak detector



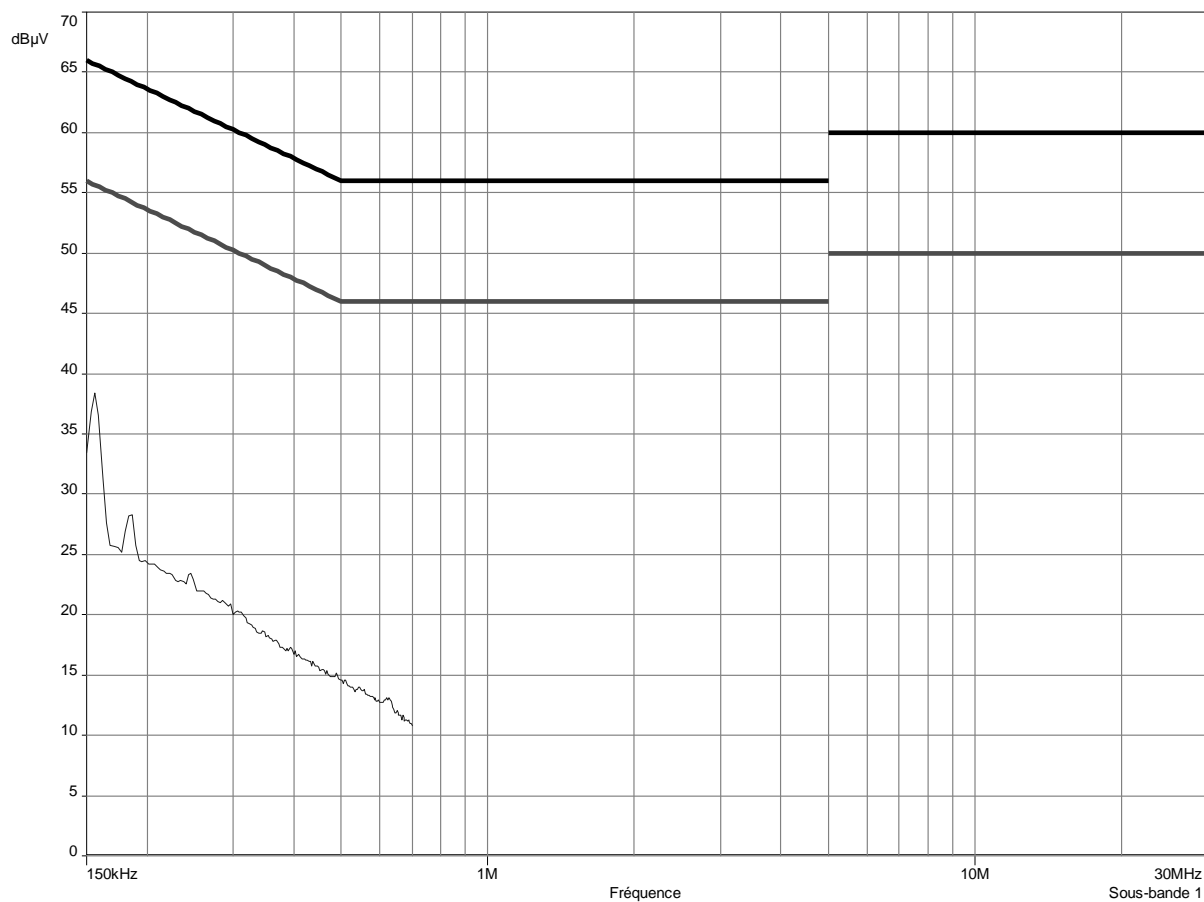
RBW filter: 10 kHz

VBW filter: 10 kHz

Sweep time: 500 ms/MHz

CURVE N°: 3.

Measurement on the neutral with average detector, from 150 kHz to 700 kHz

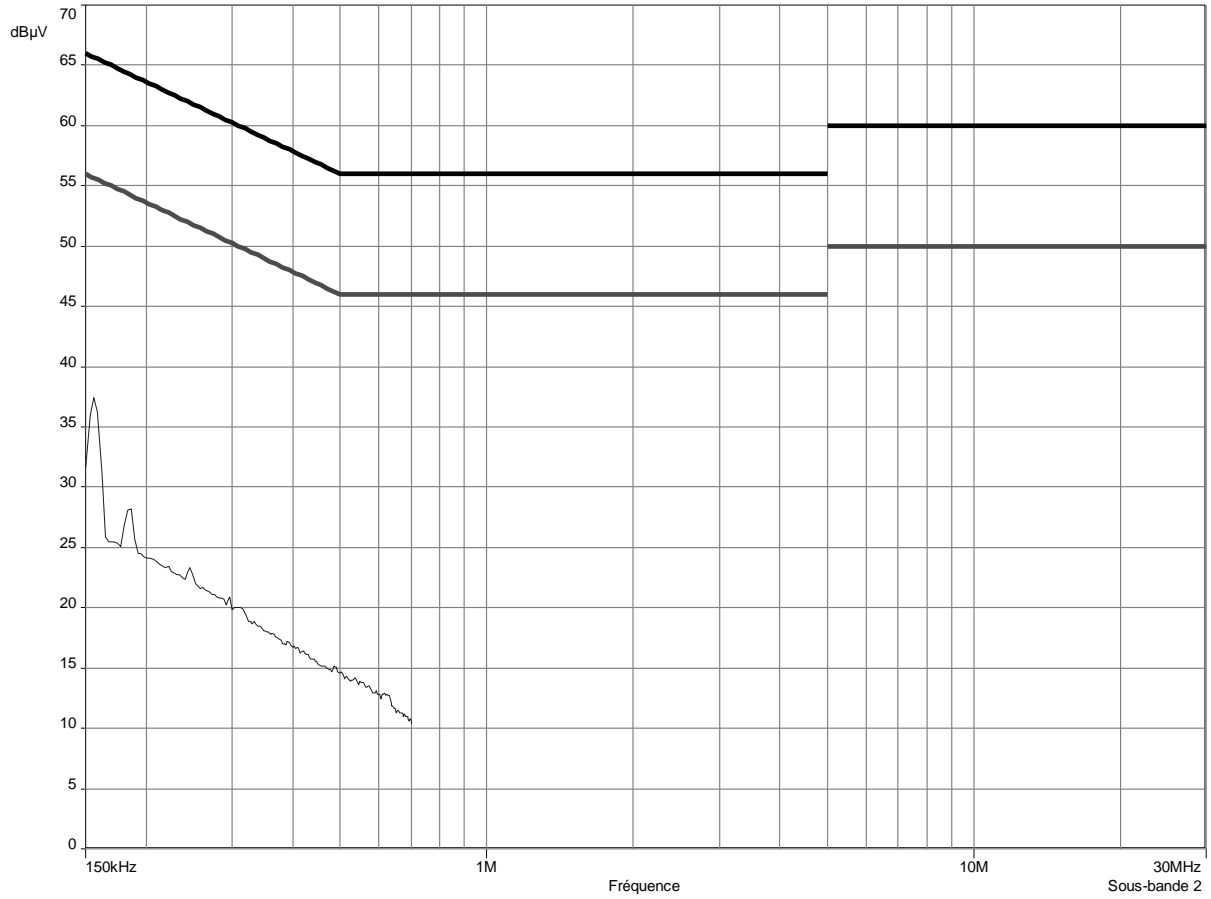


RBW filter: 9 kHz

Sweep time: 300 ms/Pts

CURVE N°: 4.

Measurement on the line with average detector, from 150 kHz to 700 kHz



RBW filter: 9 kHz
Sweep time: 300 ms/Pts

8. 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
Diode detector ODZ0004A	Omniyig	2469
Oscilloscope THS 720	Tektronix	0940
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
Variac R213	Dereix	1419

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 diode detector which is connected to the vertical channel of an oscilloscope.

The equipment under test is substituted by a signal generator with a calibrated double ridged guide antenna, and its level adjusted such that the deviation of the Y-trace of the oscilloscope reaches the level obtained with the E.U.T.

The output power level of the signal generator is measured with a calibrated RF power meter.

Then a measurement of the electro-magnetic field is realized, with a resolution bandwidth and video bandwidth adjusted at 1 MHz.

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, modulated by internal data signal.

Results:

Ambient temperature (°C): 19.5
 Relative humidity (%): 50

Polarization of test antenna: horizontal (height: 284 cm)
 Position of equipment: flat position (azimuth: 275 degrees)

Sample n° 1

		Peak Output Power radiated at these frequencies (W): from 2402 MHz to 2480 MHz	Limits (W)
Normal test conditions	Nominal power source (V): 115	14.322 x 10 ⁻³	1*

* the frequency hopping systems use at least 75 hopping channel.

Sample n° 1 Channel 1 (2402 MHz)

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 115	73.7	4.64	28.78	107.12	15.457 x 10 ⁻³

Sample n° 1 Channel 40 (2441 MHz)

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 115	74.07	4.64	28.78	107.49	16.831 x 10 ⁻³

Sample n° 1 Channel 79 (2480 MHz)

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 115	73.57	4.64	28.78	106.99	15.001 x 10 ⁻³

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

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 FSP 40	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
Variac R213	Dereix	1419
Low-noise amplifier 18 to 26 GHz	ALC	3036

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

Results:

Ambient temperature (°C): 16
Relative humidity (%): 56

Power source: 115 V.a.c. through a variac

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

FREQUENCIES (MHz)	Detector	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)
58.99	Q Peak	100	171	120	V	24.6	86.14	61.54
80	Q Peak	131	359	120	V	19.8	86.14	66.34
117.97	Q Peak	100	350	120	V	23	43.52*	20.52
176.95	Q Peak	100	166	120	V	29.1	86.14	57.04
235.94	Q Peak	128	115	120	H	43.8	86.14	42.34
294.92	Q Peak	100	253	120	H	40.1	86.14	46.04
412.88	Q Peak	100	45	120	H	42.9	86.14	43.24
590	Q Peak	132	86	120	H	33.8	86.14	52.34
634.03	Q Peak	125	138	120	H	23.1	86.14	63.04
4882.3	Avg	195	282	1000	H	43	53.98*	10.98
4882.3	Peak	195	282	1000	H	63.1	73.98	10.88
7322.16	Avg	143	13	1000	V	44.6	53.98*	9.38
7322.16	Peak	143	13	1000	V	63.3	73.98	10.68
9763.92	Peak	190	115	100	V	61.3	86.14	24.84

* 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 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 106.14 dB μ V/m on channel 40.

So the applicable limit is **86.14 dB 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

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
Variac R213	Dereix	1419

Measured condition:

Requirements: Emissions that fall in the restricted bands (part 15.205). These emissions must be less than or equal to 500 $\mu\text{V/m}$ (54 $\text{dB}\mu\text{V/m}$) 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 locked in frequency hopping mode (it's not possible to have a static mode operation).

Results:

Lower Band Edge: from 2310 MHz to 2390 MHz, (curve n° 5 and 6)

Upper Band Edge: from 2483.5 MHz to 2500 MHz, (curve n° 7 and 8)

Sample n°1:

Fundamental frequency (MHz)	Field Strength Level of fundamental ($\text{dB}\mu\text{V/m}$)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out of Band Emission Level ($\text{dB}\mu\text{V/m}$)**	Limit ($\text{dB}\mu\text{V/m}$)	Margin (dB)
2402	107.12	Peak	2388	-49.18	57.94	74	16.06
2402	69.45	Average	2329.4	-35.59	33.86	54	20.14
2480	106.99	Peak	2484	-36.2	70.79	74	3.21
2402	69.1	Average	2484	-30.74	38.36	54	15.64

* according to step 2 of Marker-Delta Method DA 00-705.

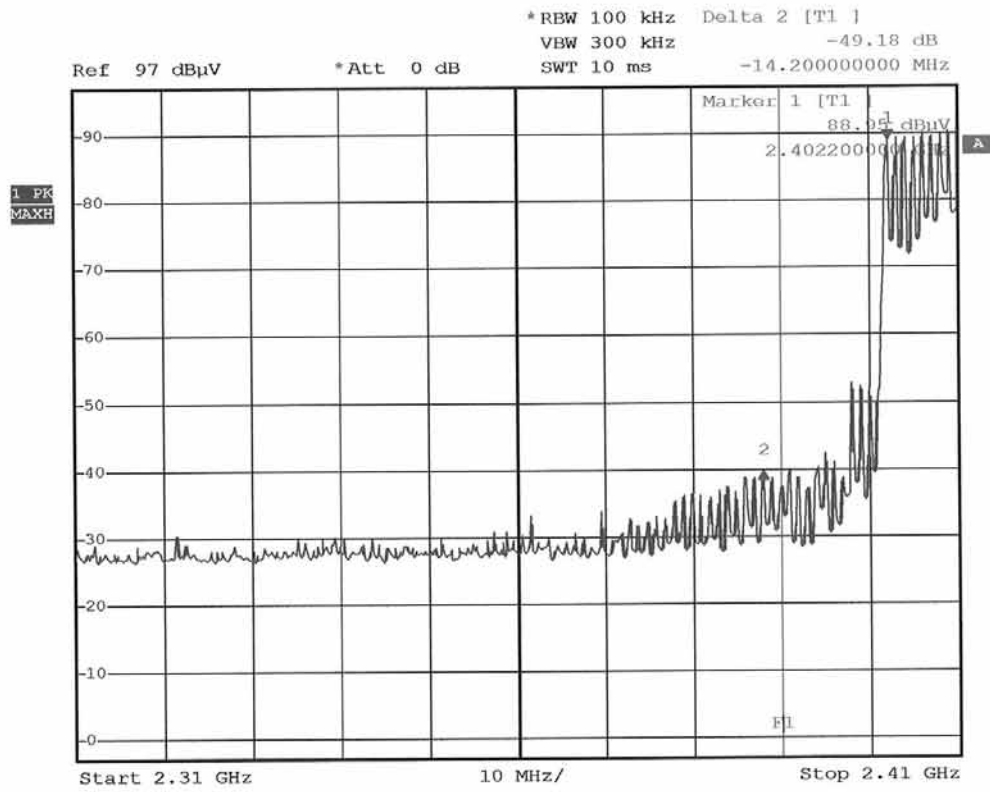
** according to step 3 of Marker-Delta Method:

$$\text{Calculated Emission Level} = \text{Field Strength Level} - \text{Delta Marker Level}$$

Test conclusion:

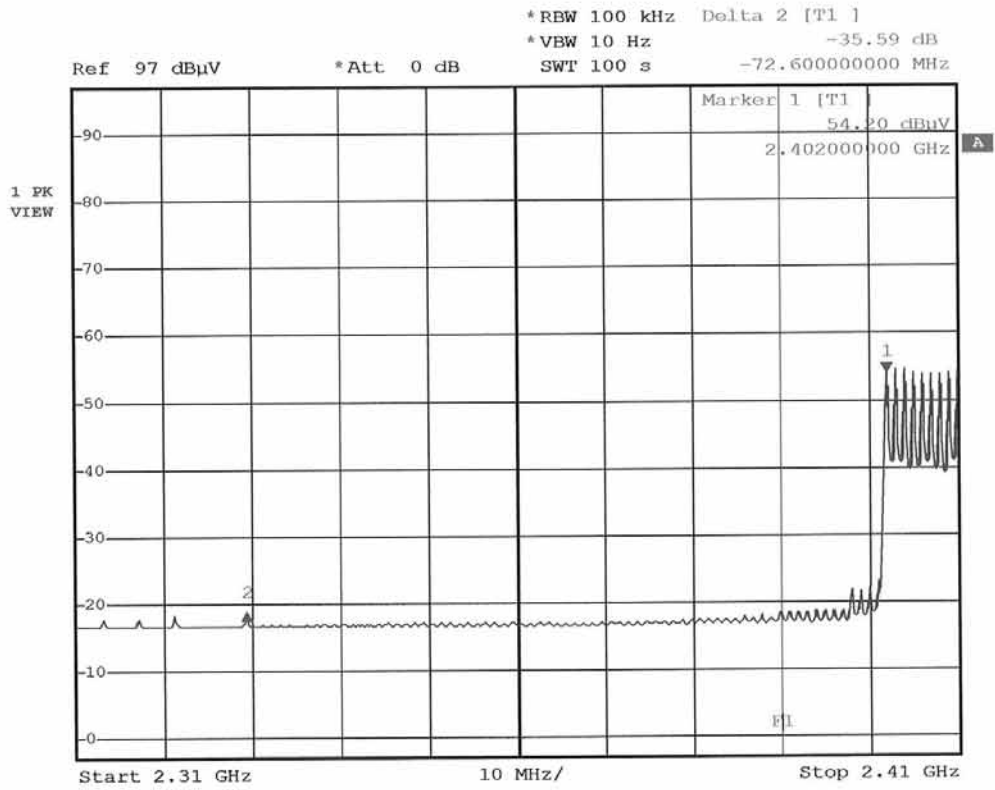
RESPECTED PUBLIC NOTICE

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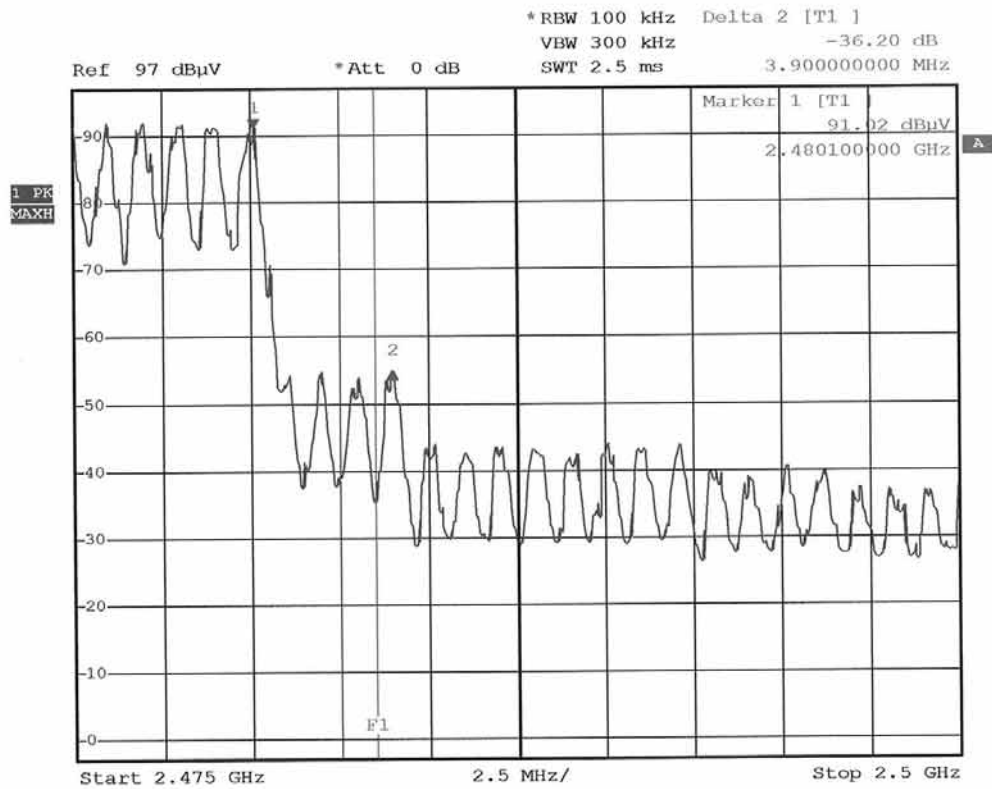
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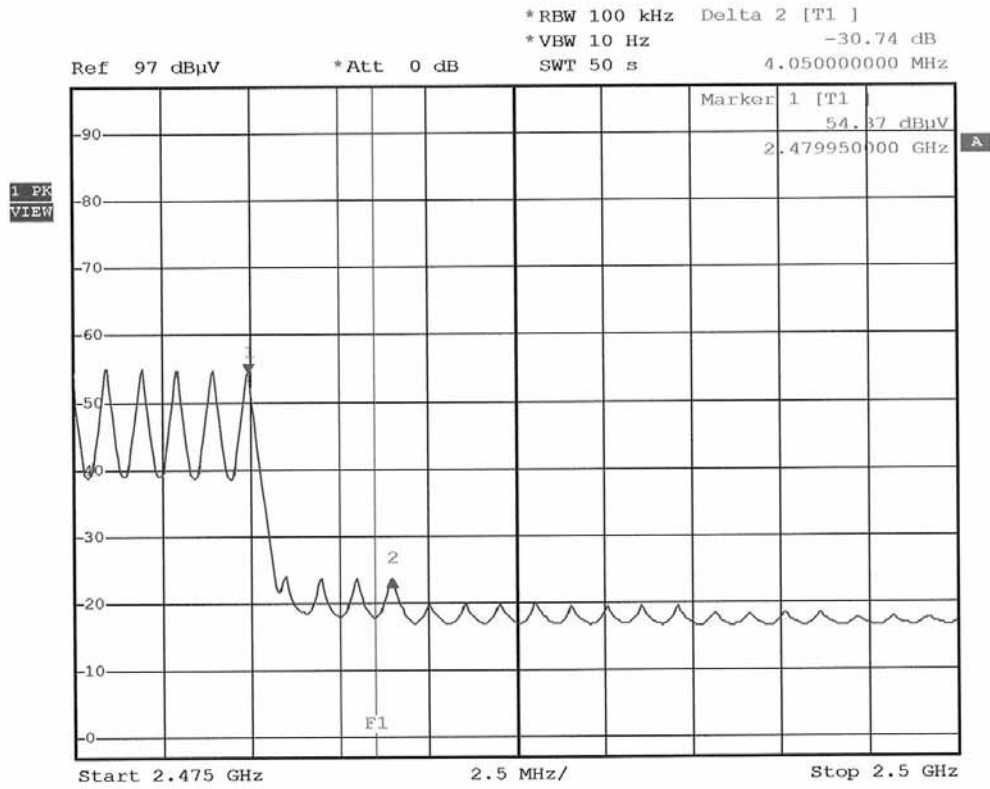
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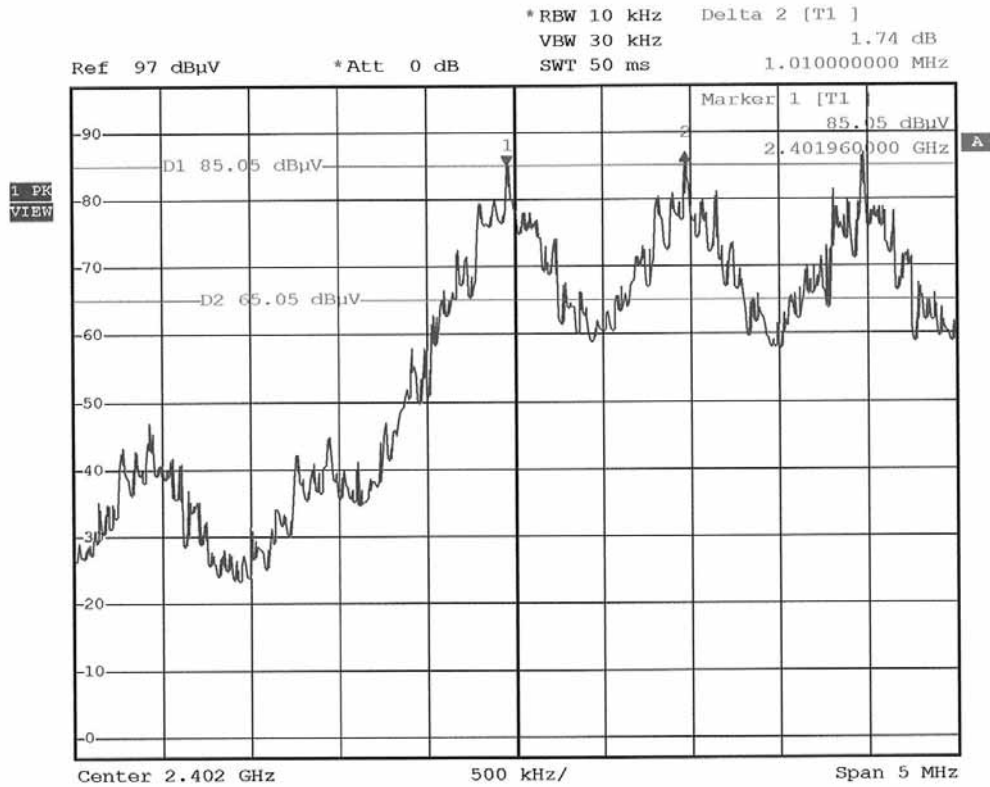
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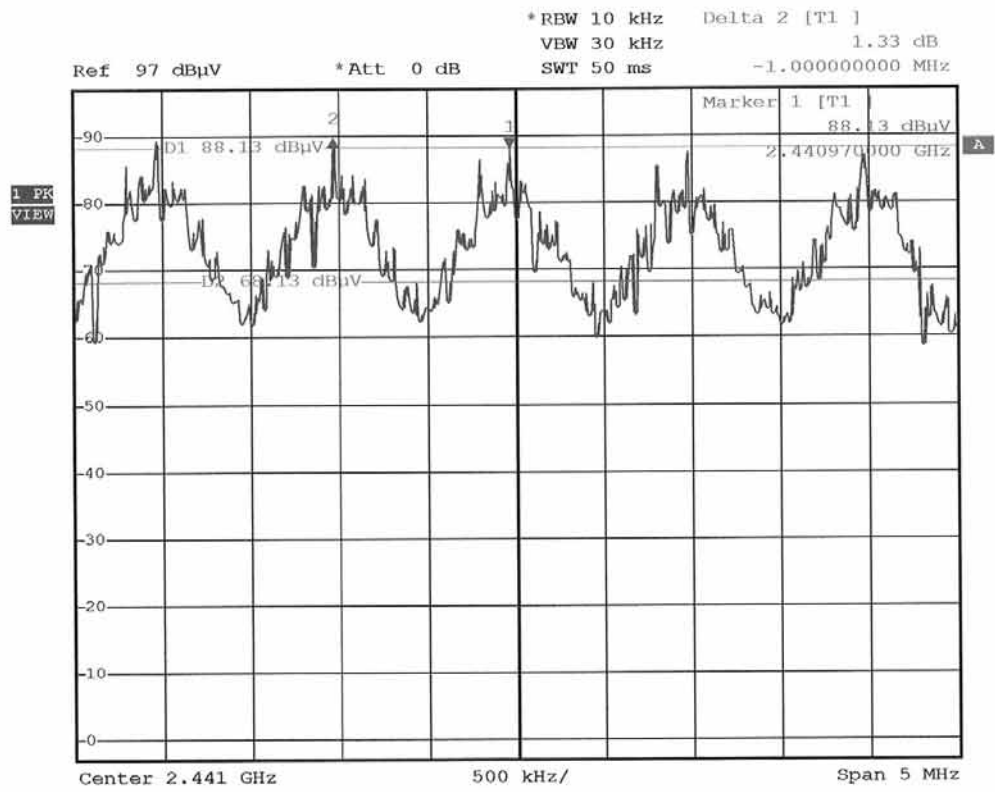
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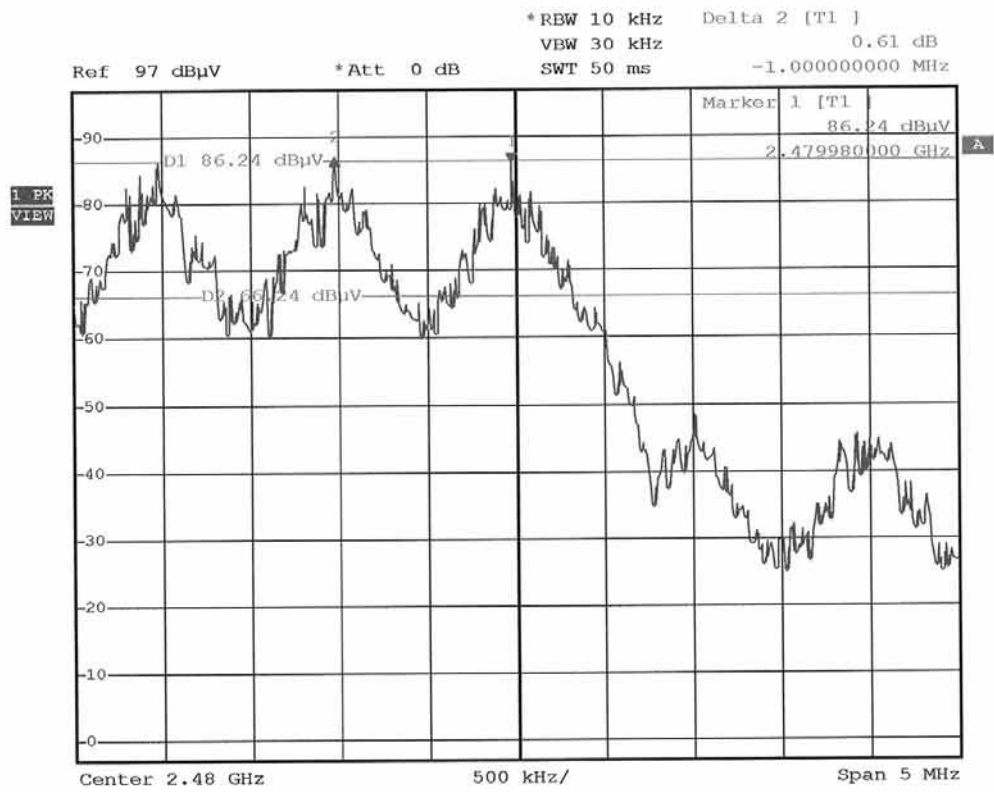
ANNEX 1: OCCUPIED POWER BANDWIDTH AND CHANNEL SEPARATION



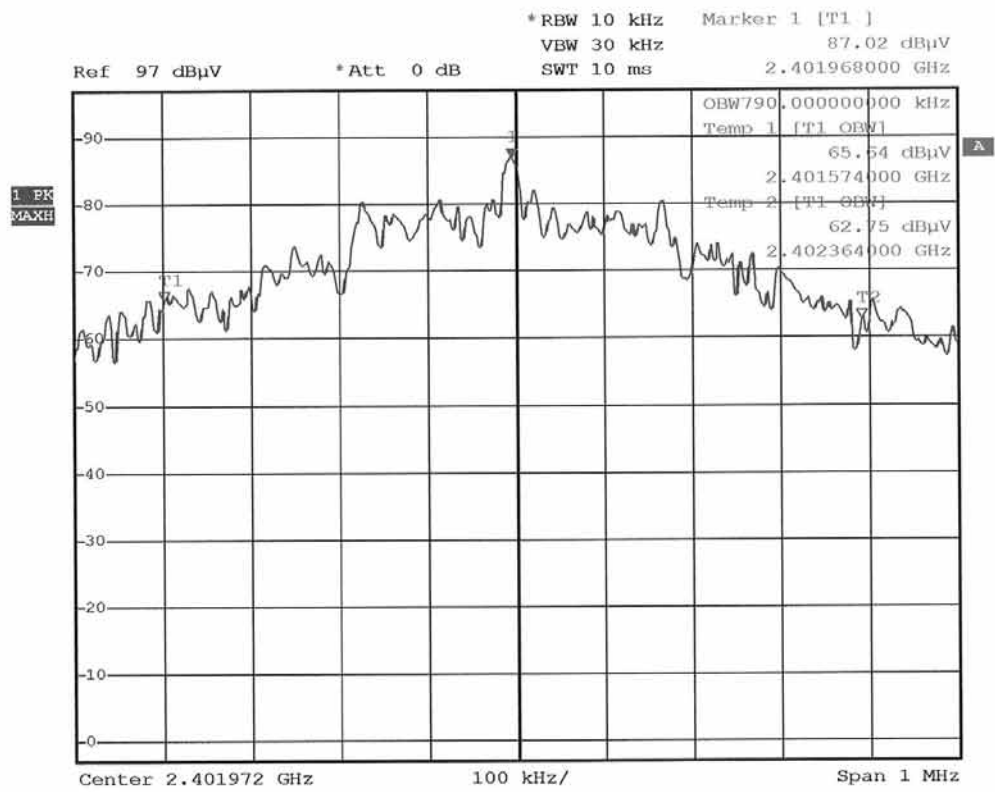
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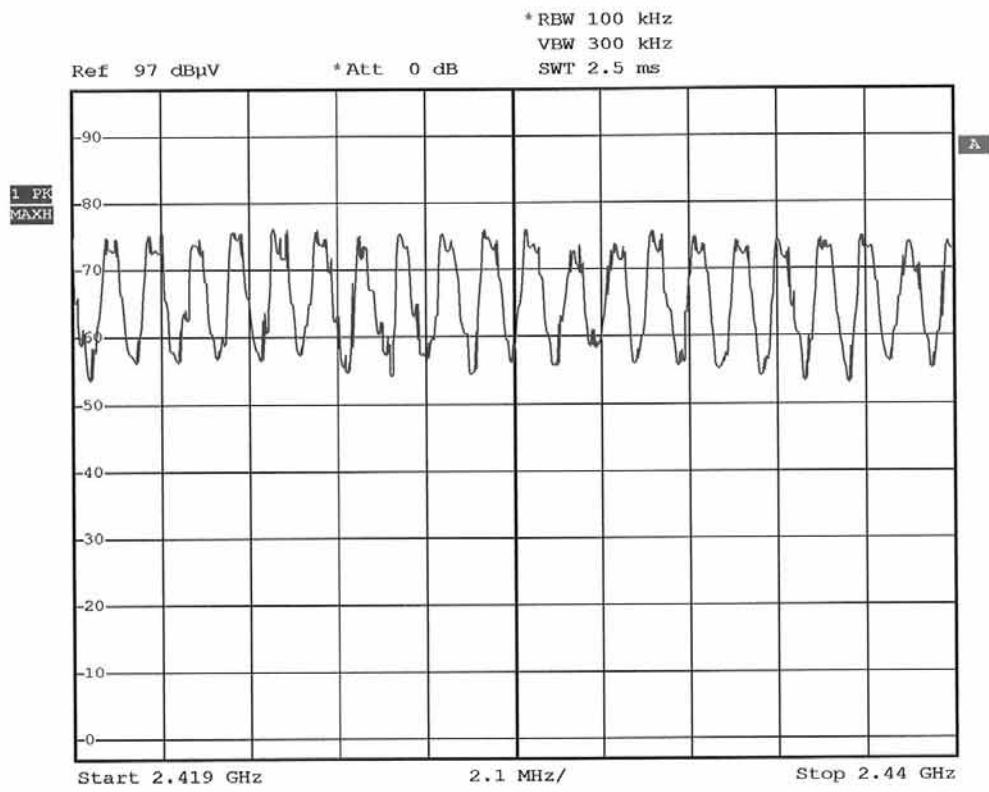
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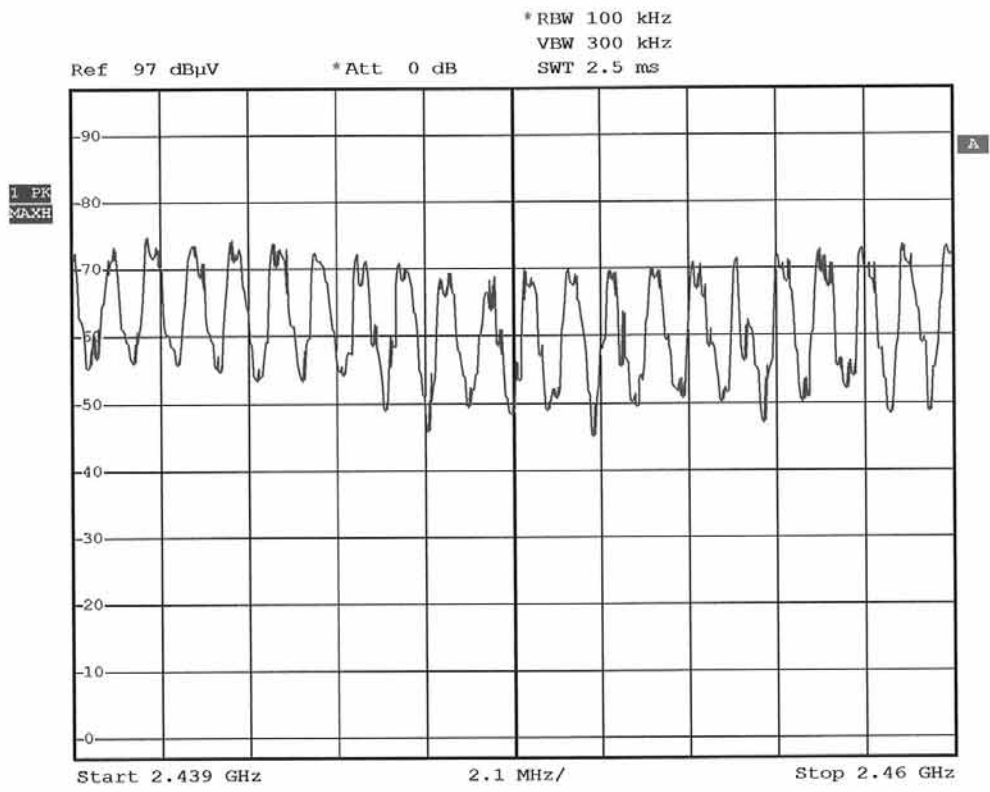
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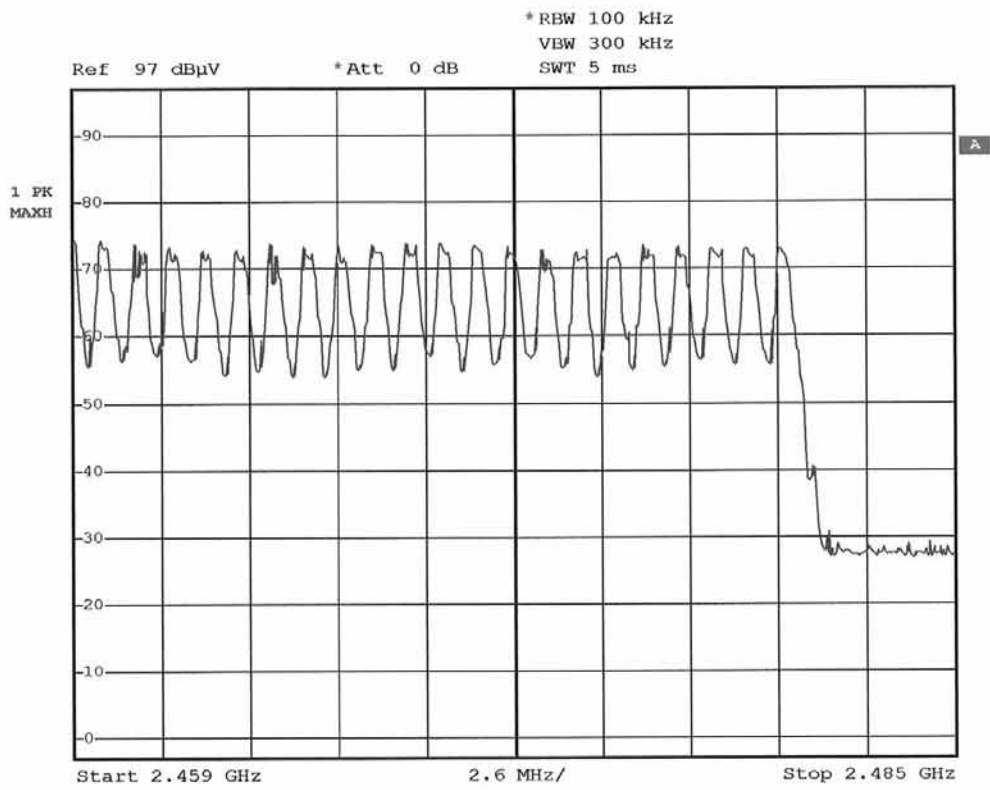
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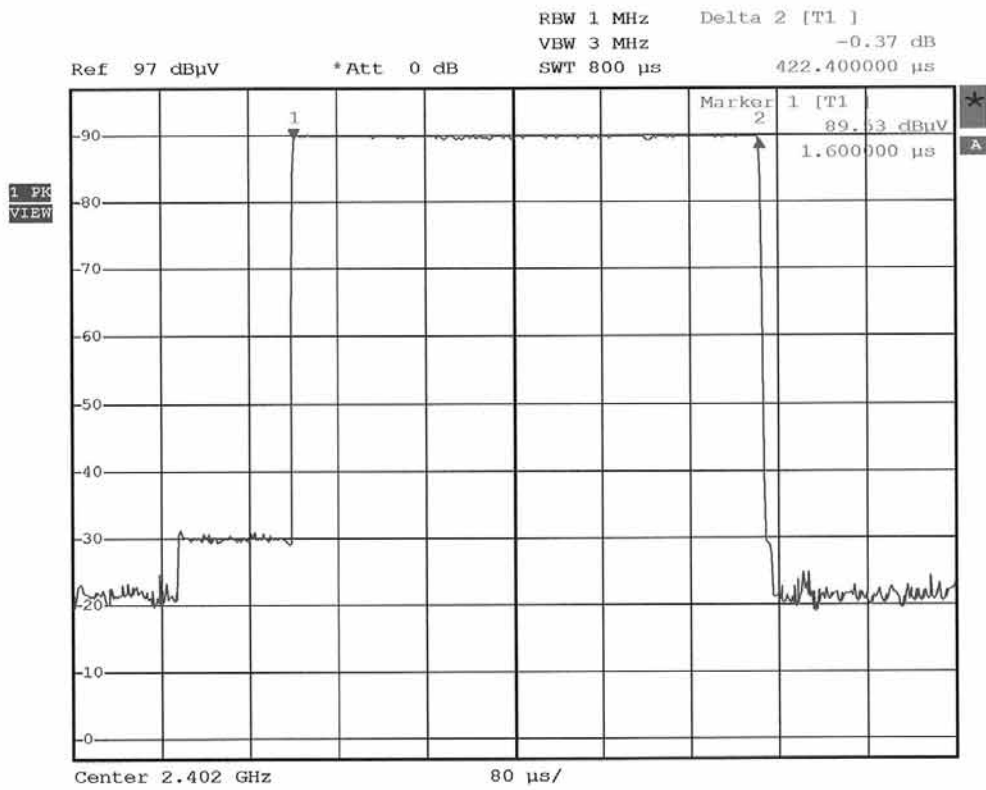
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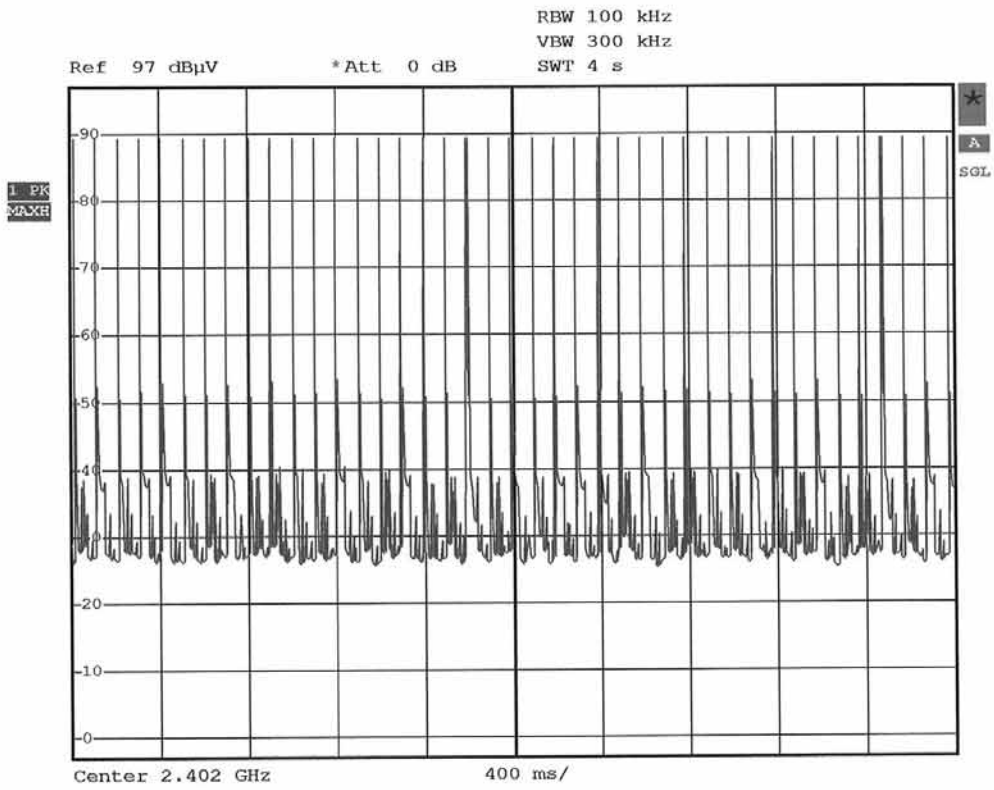
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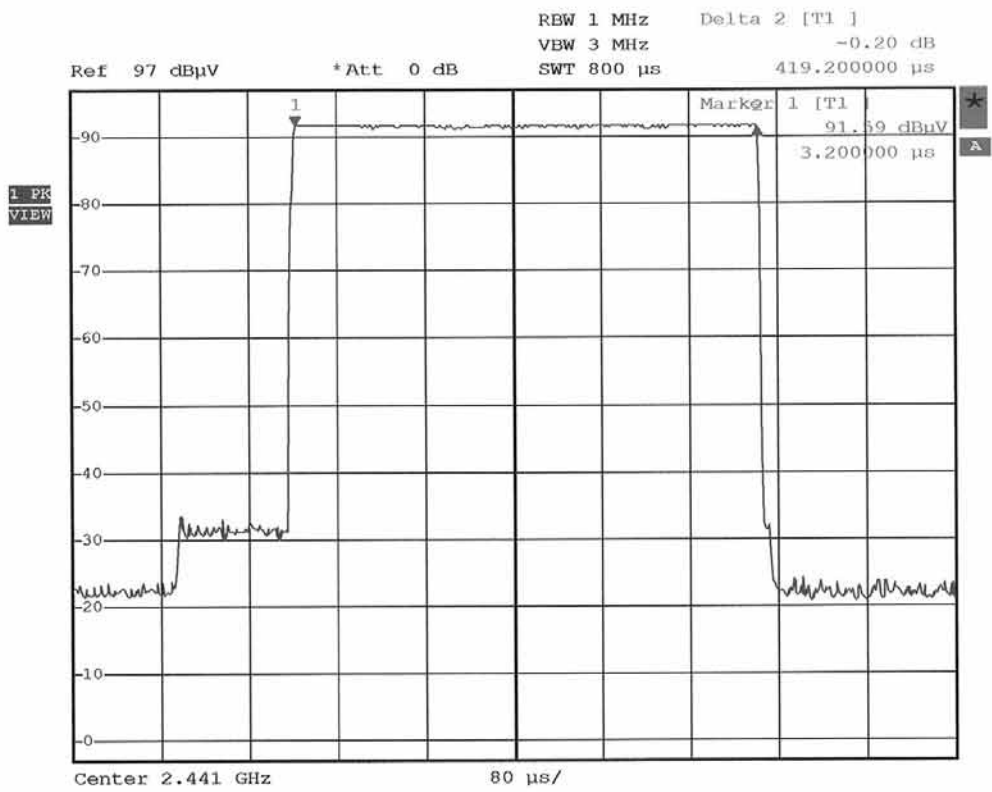
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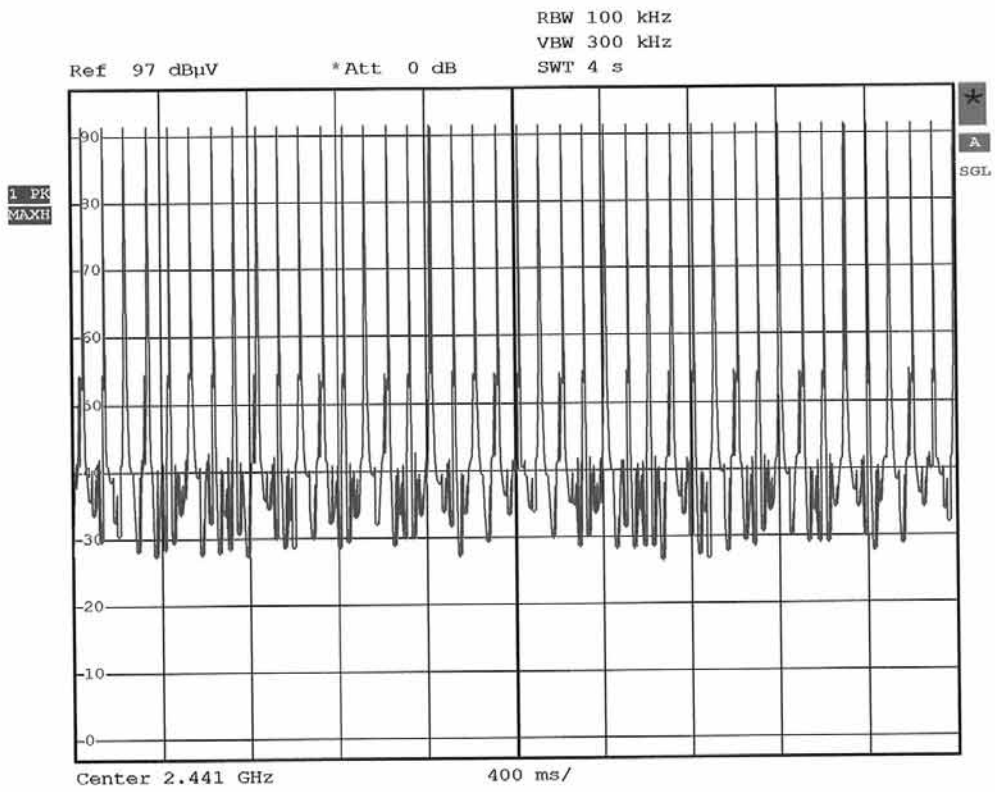
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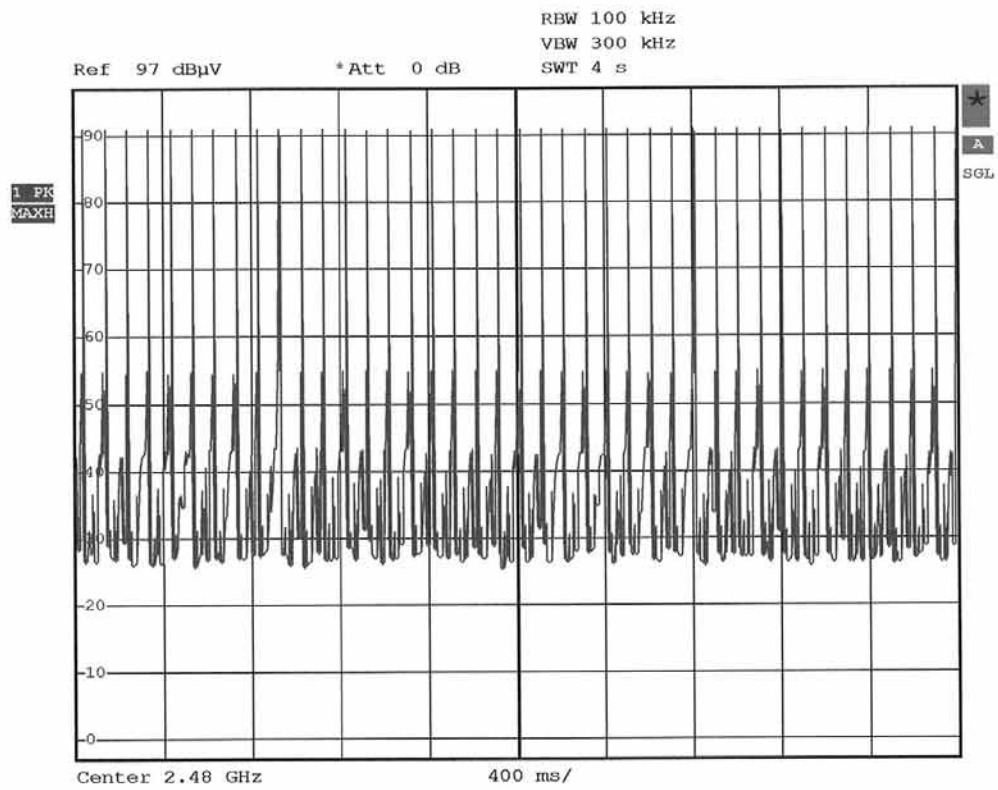
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Date: 21.DEC.2006 16:44:00



Date: 21.DEC.2006 16:42:13

ANNEX 3: PHOTOS OF THE EQUIPMENT UNDER TEST

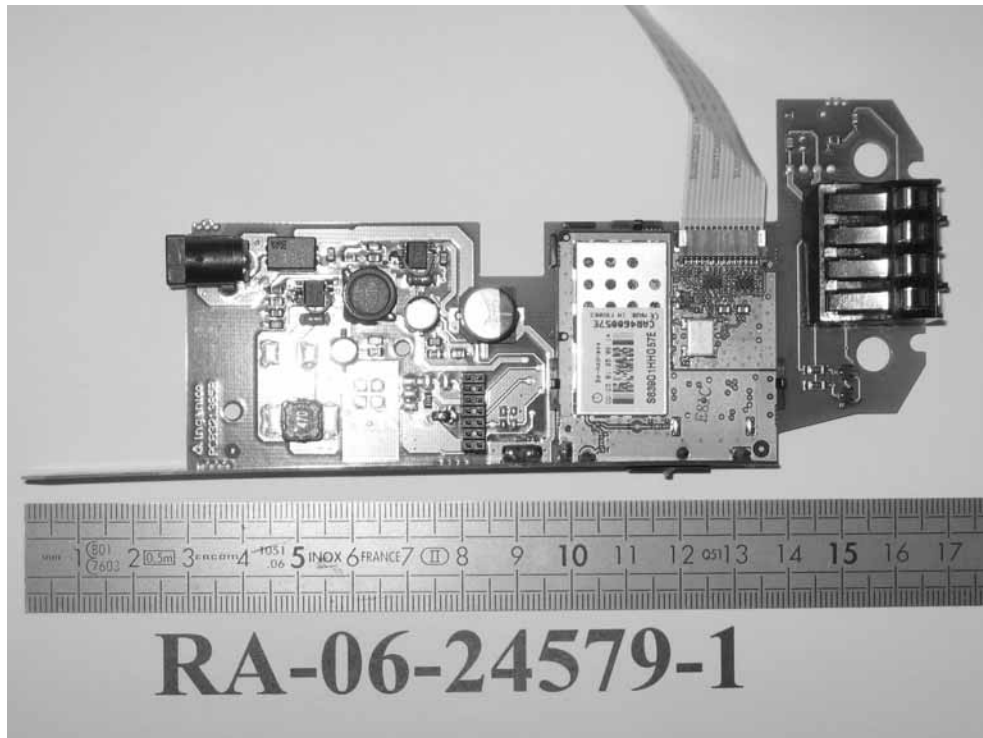
GENERAL VIEW



INTERNAL VIEW



RADIO MODULE



ANTENNA



ANNEX 4: TEST SET UP

RADIATED MEASUREMENT



CONDUCTED MEASUREMENT



ANNEX 5: PHOTOS OPEN AREA TEST SITE AND TEST SET UP

GENERAL VIEW

