

RA-24-07102853-3/A Ed. 1

“This report cancels and replaces the test report n° RA-24-07102853-3/A Edition 0”

FCC CERTIFICATION RADIO Measurement Technical Report

standards to apply:
FCC Part 15.247
LIMITED MODULAR APPROVAL

Equipment under test:
EvoModule 1

FCC ID :
S28-EvoModule 1

Company:
CORONIS SYSTEMS

DISTRIBUTION: Mr GALLON

Company: CORONIS SYSTEMS

Number of pages: 34 including 5 annexes

Ed.	Date	Modified pages	Written by		Technical Verification Quality Approval	
			Name	Visa	Name	Visa
1	4-Nov-08	4 and 6	L. BERTHAUD	LB		

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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: EVOMODULE 1

Serial number: 125408400026

MANUFACTURER: not communicated

COMPANY SUBMITTING THE PRODUCT:

Company: CORONIS SYSTEMS

Address: Espace concorde-Bât B
120 impasse JB Say
34470 PEROLS
FRANCE

Responsible: Mr GALLON

DATE(S) OF TEST: 06, 07 and 08 October 2008

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

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1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment:
EvoModule 1 in accordance with normative reference.

2. PRODUCT DESCRIPTION

Class: A (commercial, industrial or business environment)

Utilization: radio module

Antenna type: dedicated antenna

1 | Operating frequency range: from 904.8384 MHz to 925.1136 MHz

Number of channels: 63

Channel spacing: 170 kHz (minimum)

Frequency generation: ☐ SAW Resonator ☐ Crystal ☒ Synthetiser

Modulation: Frequency Hopping Spread Spectrum (FHSS)
☐ Amplitude ☐ Digital ☒ Frequency ☐ Phase

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 (2007) 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 902-928 MHz, 2400-2483.5 MHz and 5725-5850 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	
1 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 15.247	OPERATION WITHIN THE BAND 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) <i>hopping systems</i>	X				Note 4
	(a) (1) (i) 902 – 928 MHz	X				Note 5
	(a) (1) (ii) 5725 – 5850 MHz			X		
	(a) (1) (iii) 2400 – 2483.5 MHz			X		
	(a) (2) <i>digital modulation techniques</i>			X		
1	(b) <i>max output power</i>	X				
	(c) <i>operation with directional antenna gains > 6 dBi</i>			X		
	(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
DA 00-705	BAND EDGE COMPLIANCE	X				

NAp: Not Applicable

NAs: Not Asked

1 | Note 1: see photos in annex 4.

Note 2: the equipment under test is directly supplied by a waveport module provided by the applicant.

Note 3: see FCC part 15.247 (d).

Note 4: the system hops 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 (47 kHz; see annex 1).

Note 5: the frequency hopping system uses 63 channels (see annex 2).

The timing by channel is 1.104 ms. During 20 s, any channel is used 248 times, then $248 \times 1.104 \text{ ms} = 273.792 \text{ ms}$, thus the average time of occupancy on any channel is less than 400 ms within a period of 20 s (see annex 3).

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).

Conclusion:

The sample of EVOMODULE 1 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
Open site	EMITECH	1274
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Variac R213	Dereix	1419
Logperiodic antenna HL223	Rohde & Schwarz	1999

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 and substitution method. 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.

The measurement of the electro-magnetic field is realized, with a resolution bandwidth adjusted at 100 kHz.

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): 21
Relative humidity (%): 69

Power source: the equipment under test is directly supplied by a waveport module provided by the applicant.

Sample n° 1 Channel 1

	Electro-magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	124.3	0.489	1

Polarization of test antenna: vertical (height: 122 cm)

Position of equipment: vertical antenna (azimuth: 126 degrees)

Sample n° 1 Channel 22

	Electro-magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	124.2	0.478	1

Polarization of test antenna: vertical (height: 116 cm)

Position of equipment: vertical antenna (azimuth: 125 degrees)

Sample n° 1 Channel 43

	Electro-magnetic field (dBμV/m):	P* (W)	Limit (W)
Normal test conditions	123.6	0.417	1

Polarization of test antenna: vertical (height: 113 cm)

Position of equipment: vertical antenna (azimuth: 120 degrees)

* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3$ m and $G_p = 1.65$

Test conclusion:

RESPECTED STANDARD

8. 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 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): 18.5

Relative humidity (%): 72

Power source: the equipment under test is directly supplied by a wave port module provided by the applicant.

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)
1809.65	Peak	100	227	100	V	50.37	104.3	53.93
2714.47	Peak	138	0	1000	V	48.71	73.98*	25.27
2714.47	Avg	138	0	1000	V	27.51	53.98*	26.47

Channel 22

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)
1830.62	Peak	101	0	100	V	59.07	104.3	45.23
2745.94	Peak	161	0	1000	V	45.31	73.98*	28.67
2745.94	Avg	161	0	1000	V	25.21	53.98*	28.77

Channel 43

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)
1850.2	Peak	134	27	100	V	74.57	104.3	29.73
2775.31	Peak	100	0	1000	V	56.11	73.98*	17.87
2775.31	Avg	100	0	1000	V	32.81	53.98*	21.17

* 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 124.3 dBμV/m on channel 1.

So the applicable limit is 104.3 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)).

Any spurious that has more than 20 dB of margin compared to the applicable limit is not necessary reported.

Test conclusion:

RESPECTED STANDARD

9. 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	1938
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 blocked in frequency hopping mode.

Results:

Lower Band Edge: from 608 MHz to 614 MHz, CURVE n° 1 & 2

Upper Band Edge: from 960 MHz to 1240 MHz, CURVE n° 3 & 4

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)
904.8384	124.3	Peak	611.78	-70.58	53.72	66.02	12.3
904.8384	97.7	Average	613.64	-54.21	43.49	46.02	2.53
925.1136	123.6	Peak	1103.48	-65.59	58.01	73.98	15.97
925.1136	96.7	Average	1112.06	-49.94	46.76	53.98	7.22

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

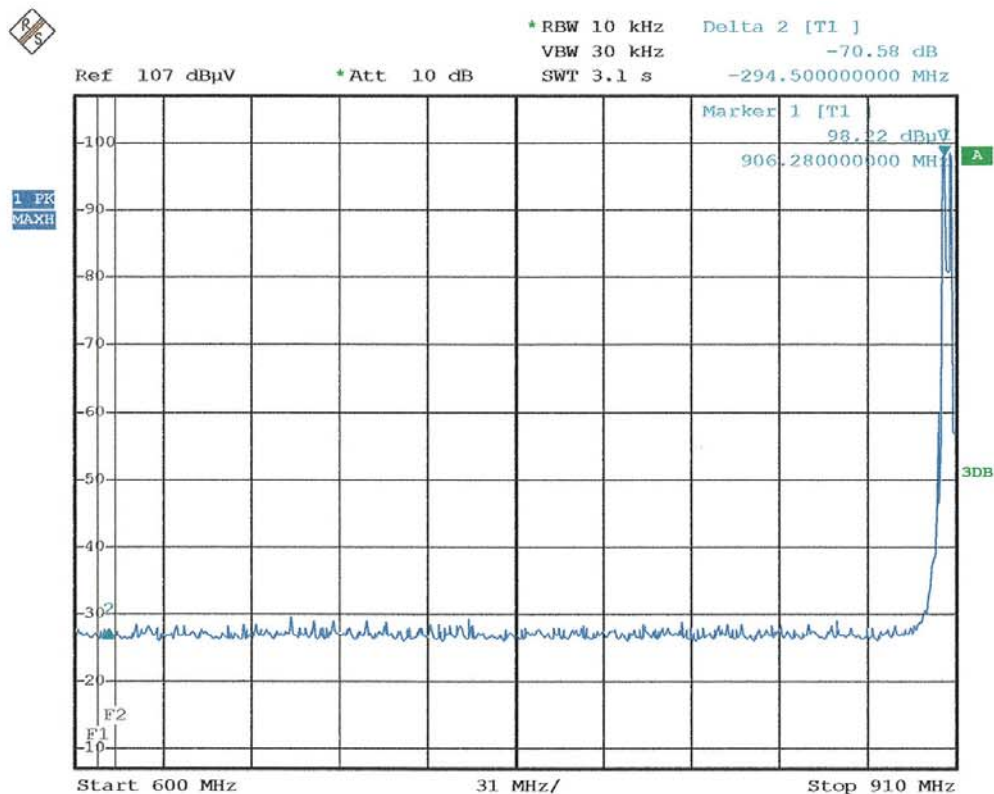
** according to step 3 of Marker-Delta Method:

Calculated Emission Level = Field Strength Level – Delta Marker Level

Test conclusion:

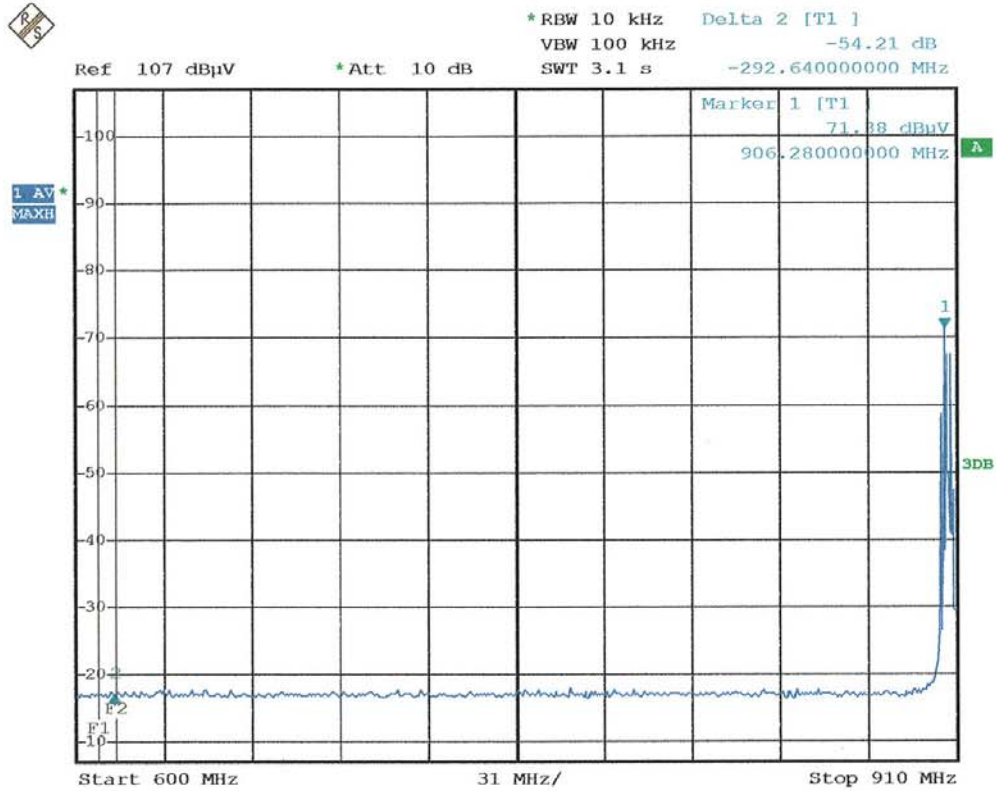
RESPECTED PUBLIC NOTICE

CURVE N° 1.



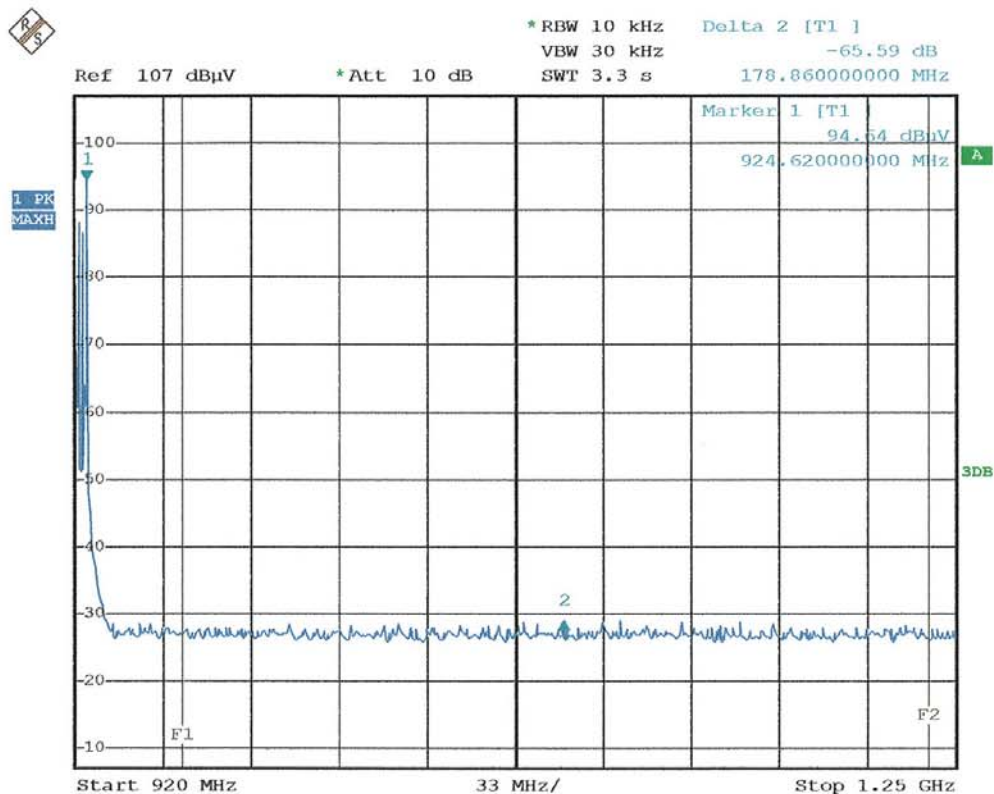
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CURVE N° 2.



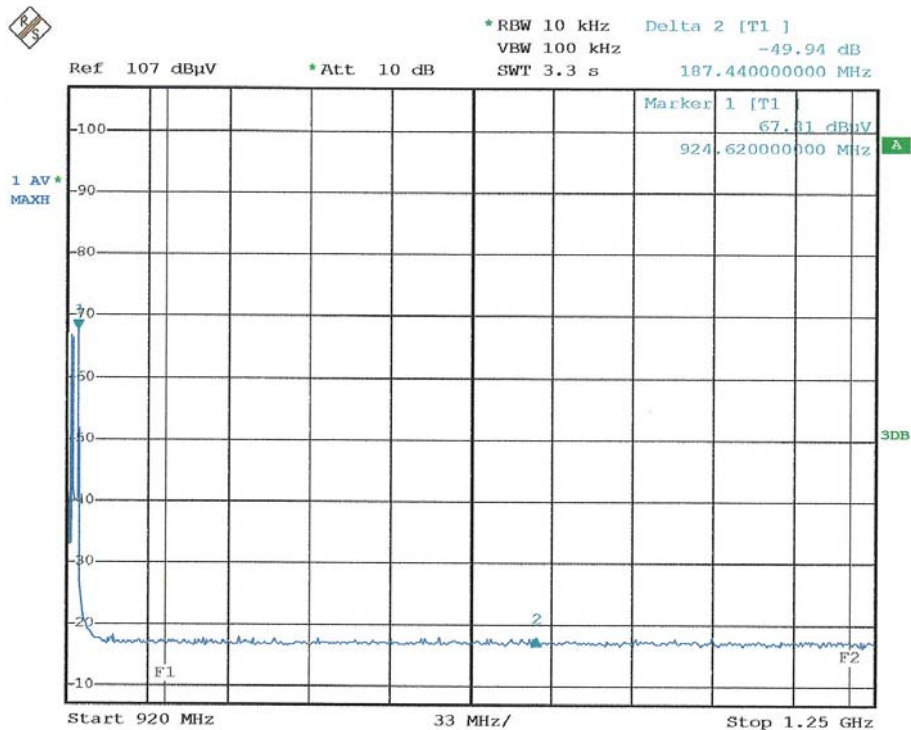
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CURVE N° 3.



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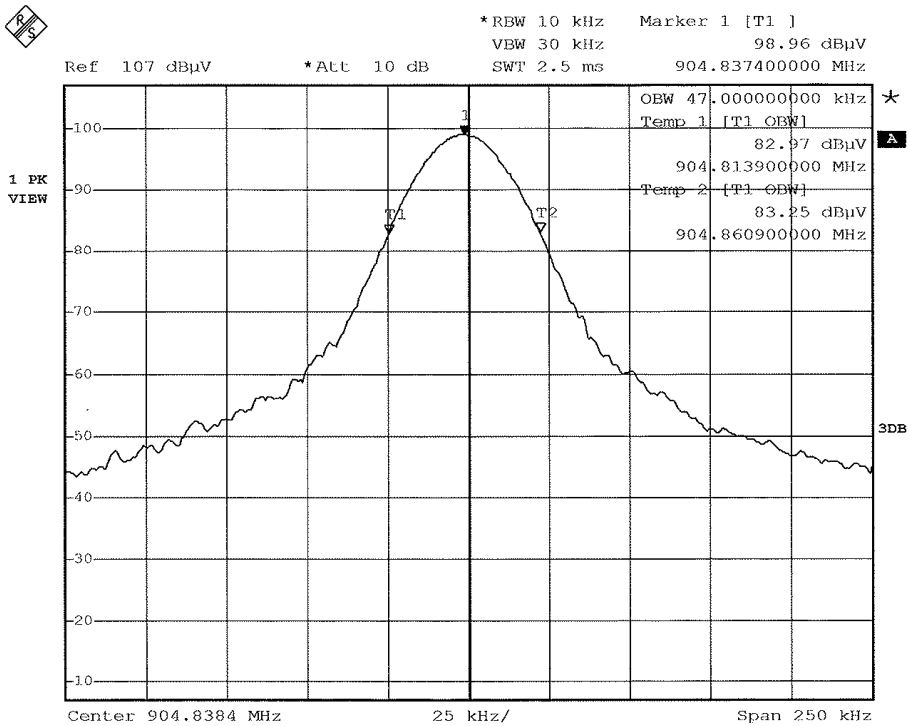
CURVE N° 4.



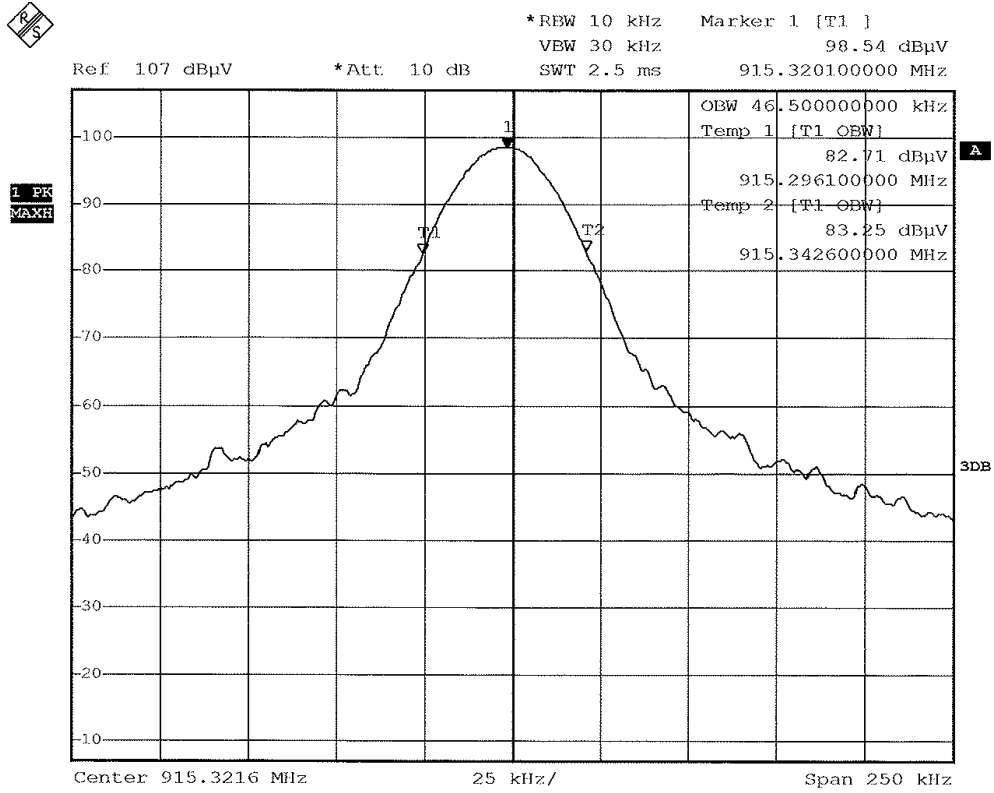
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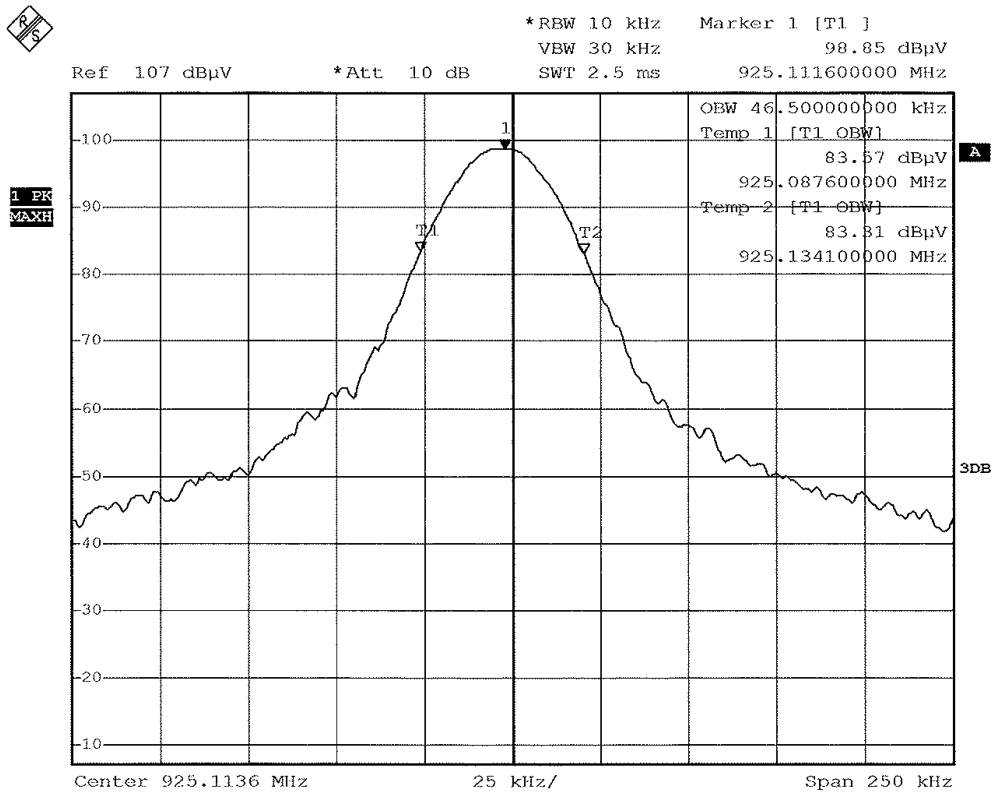
ANNEX 1: OCCUPIED POWER BANDWIDTH AND CHANNEL SEPARATION



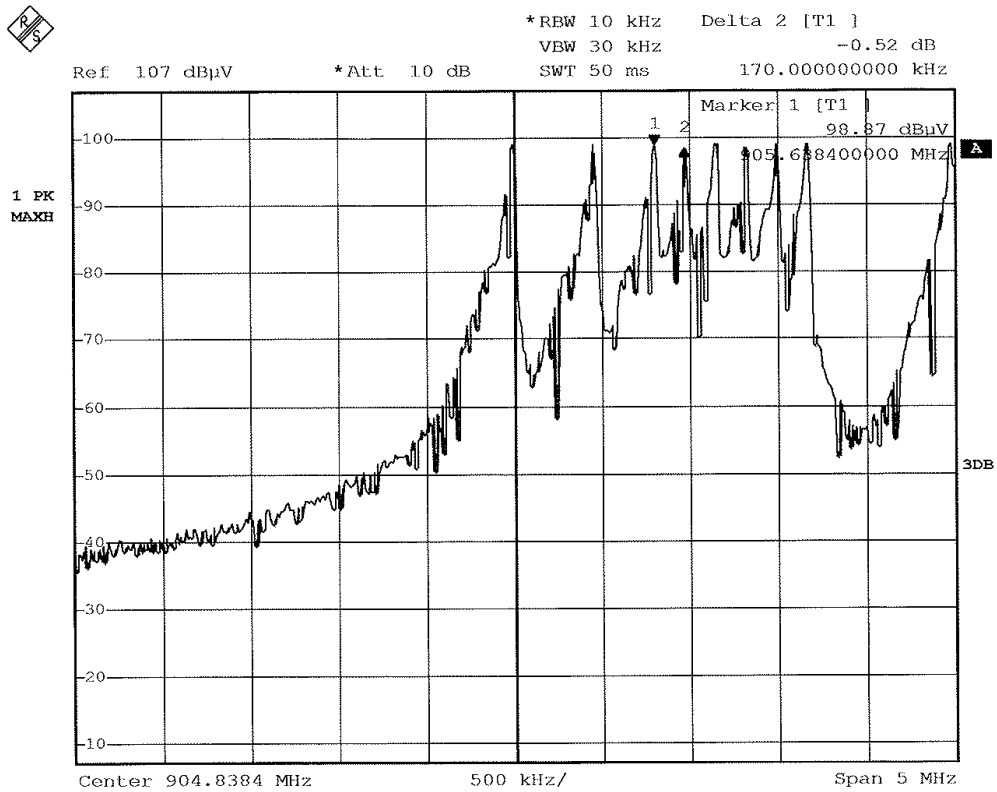
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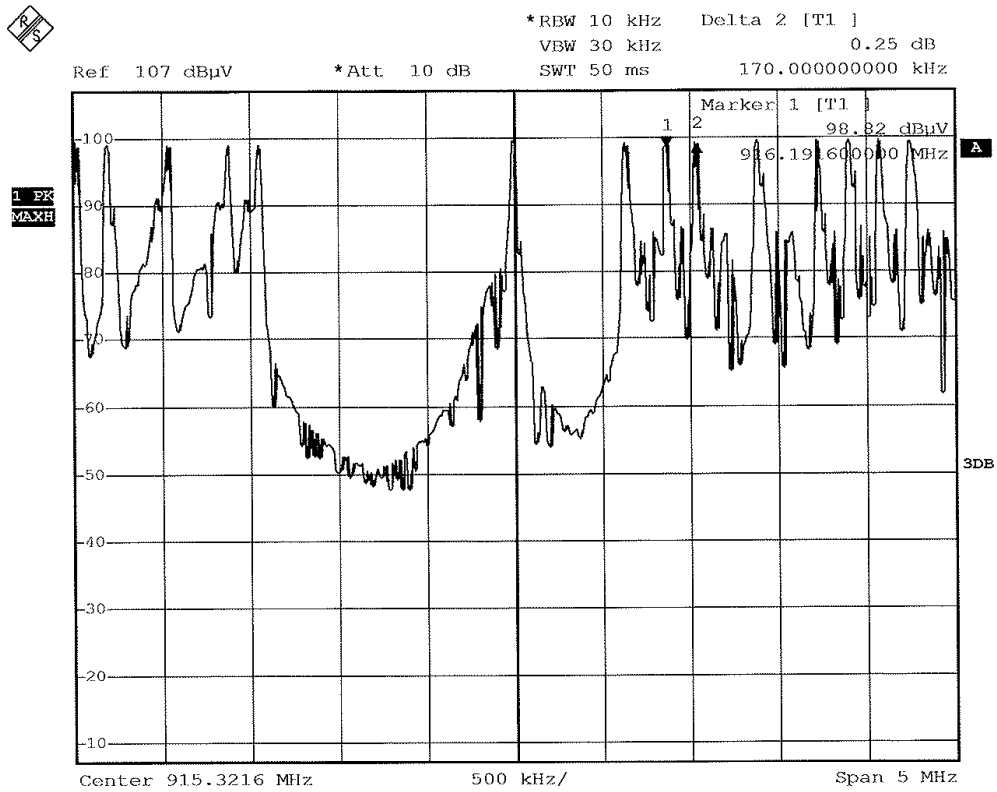
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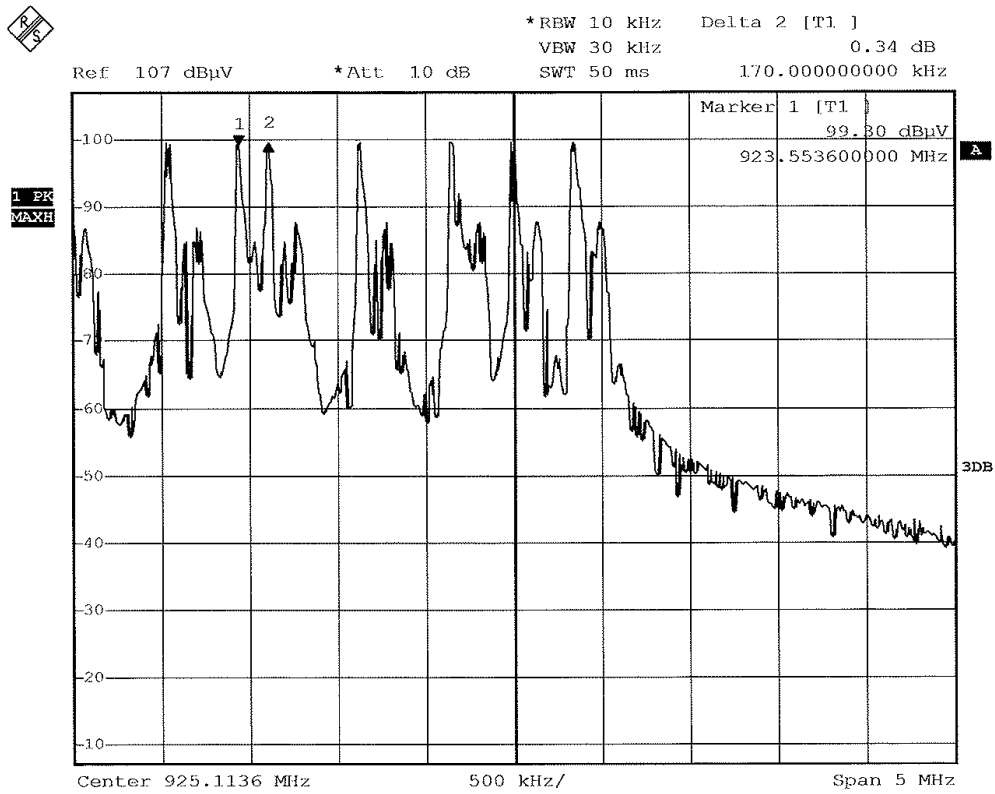
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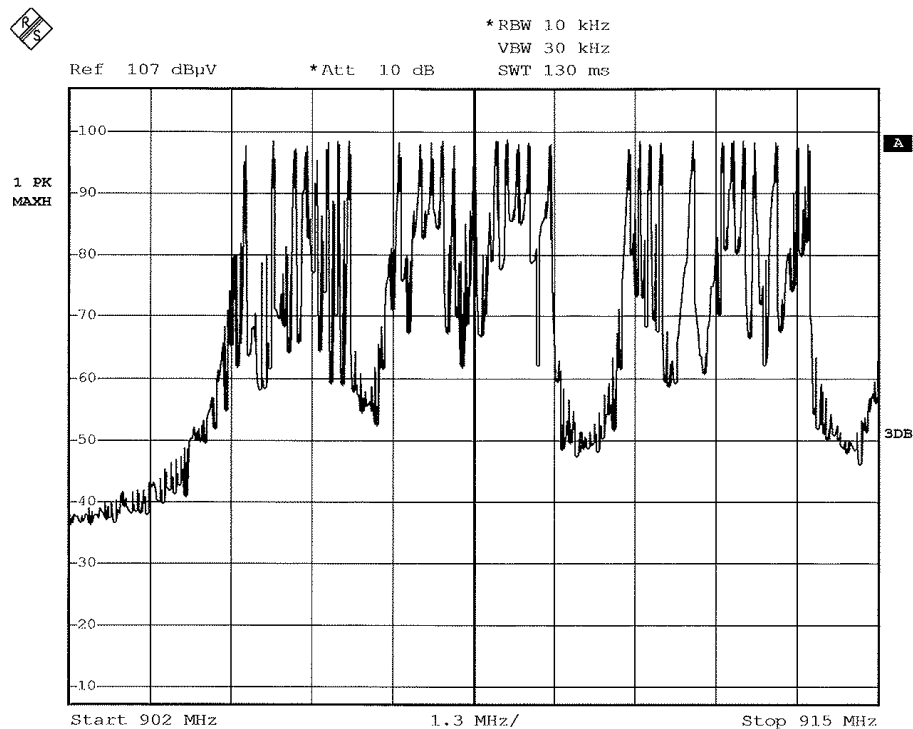


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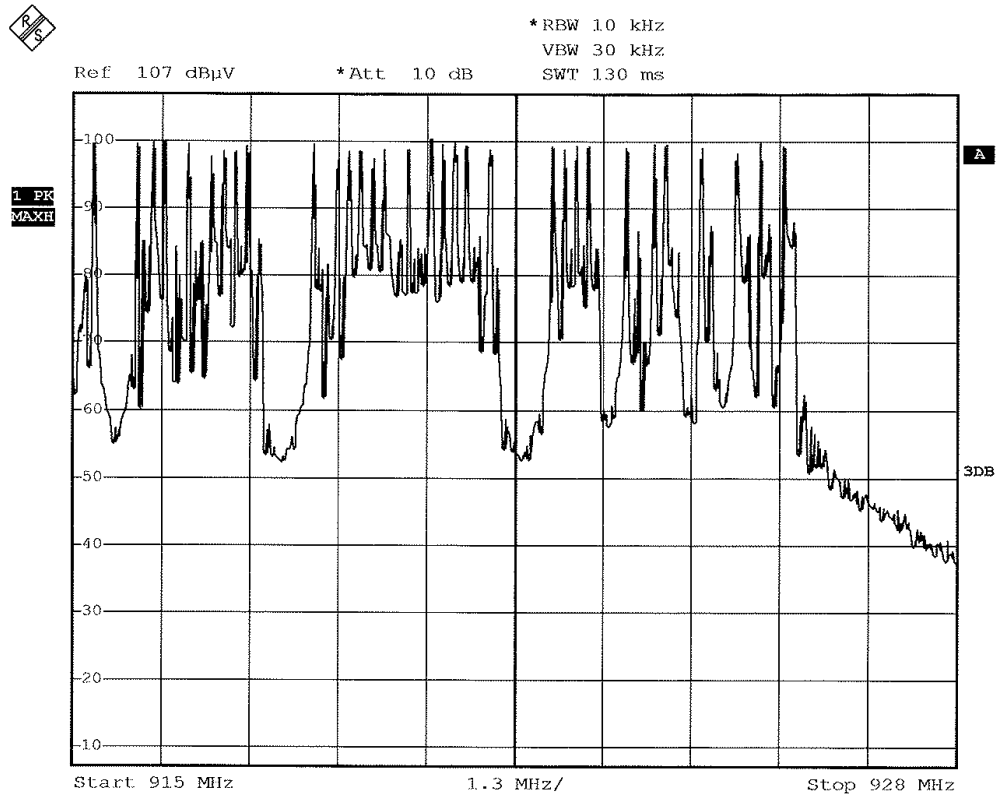


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ANNEX 2: NUMBER OF HOPPING FREQUENCIES



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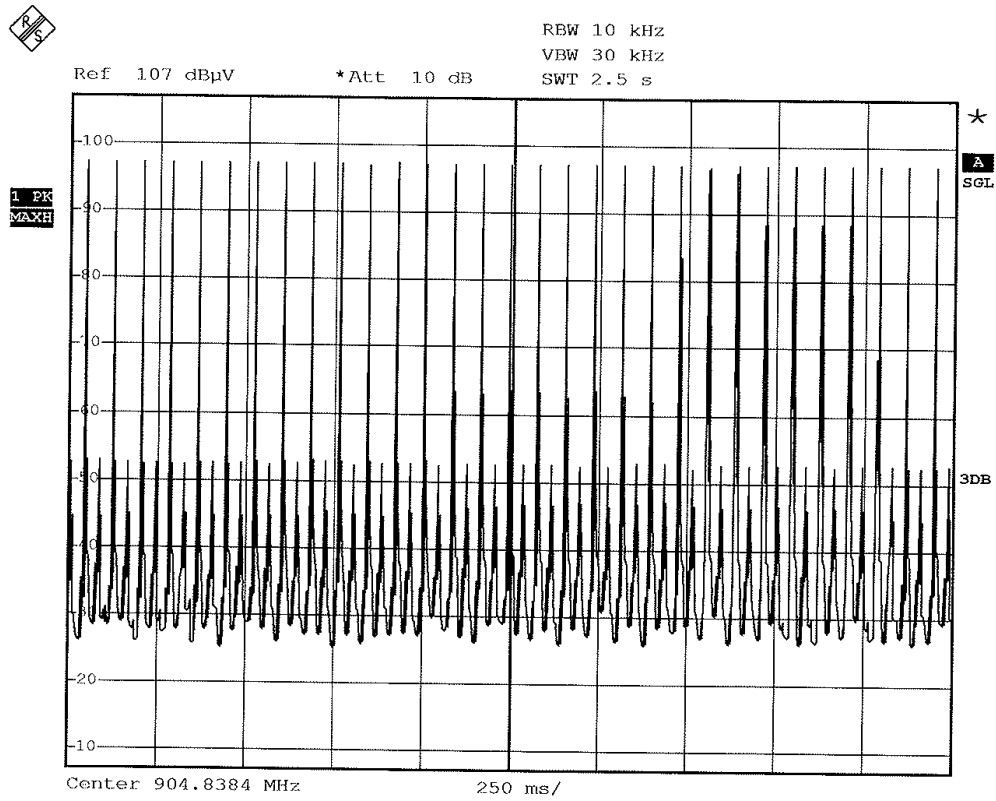


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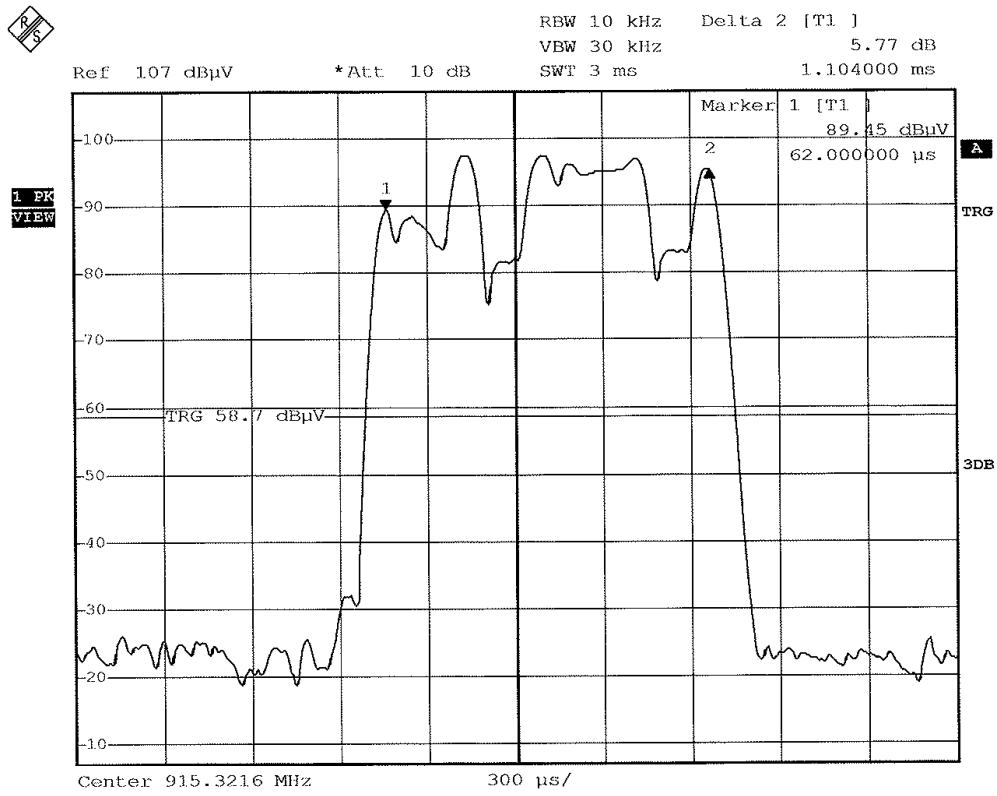
ANNEX 3: AVERAGE TIME OF OCCUPANCY ON ANY FREQUENCY



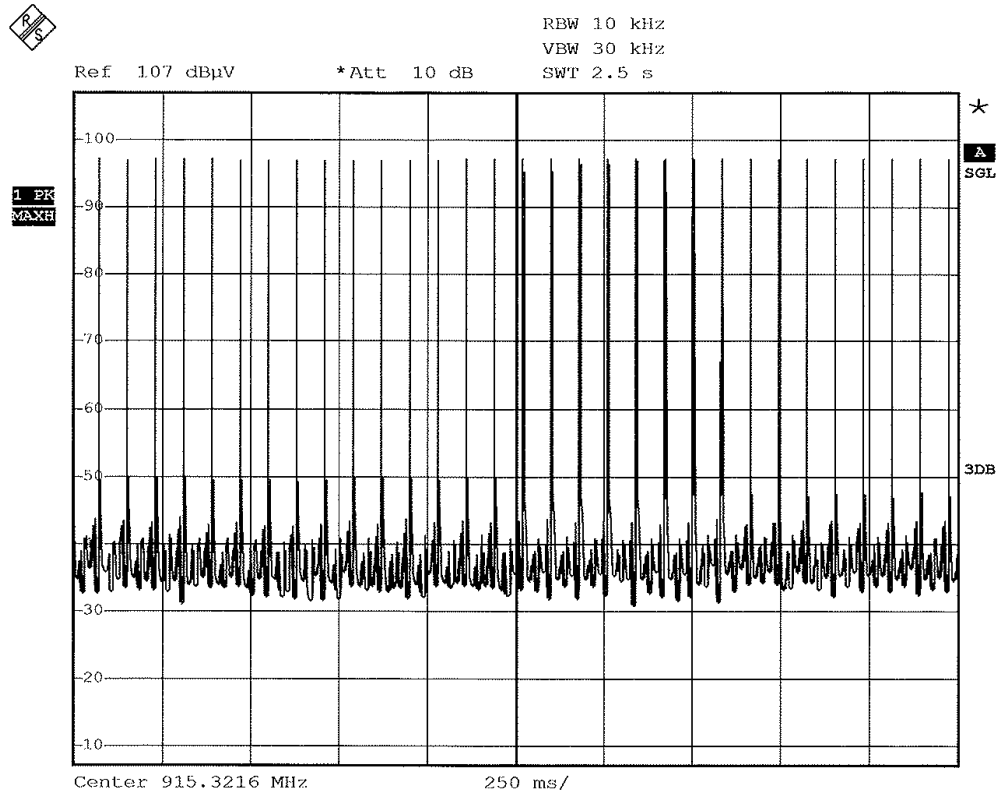
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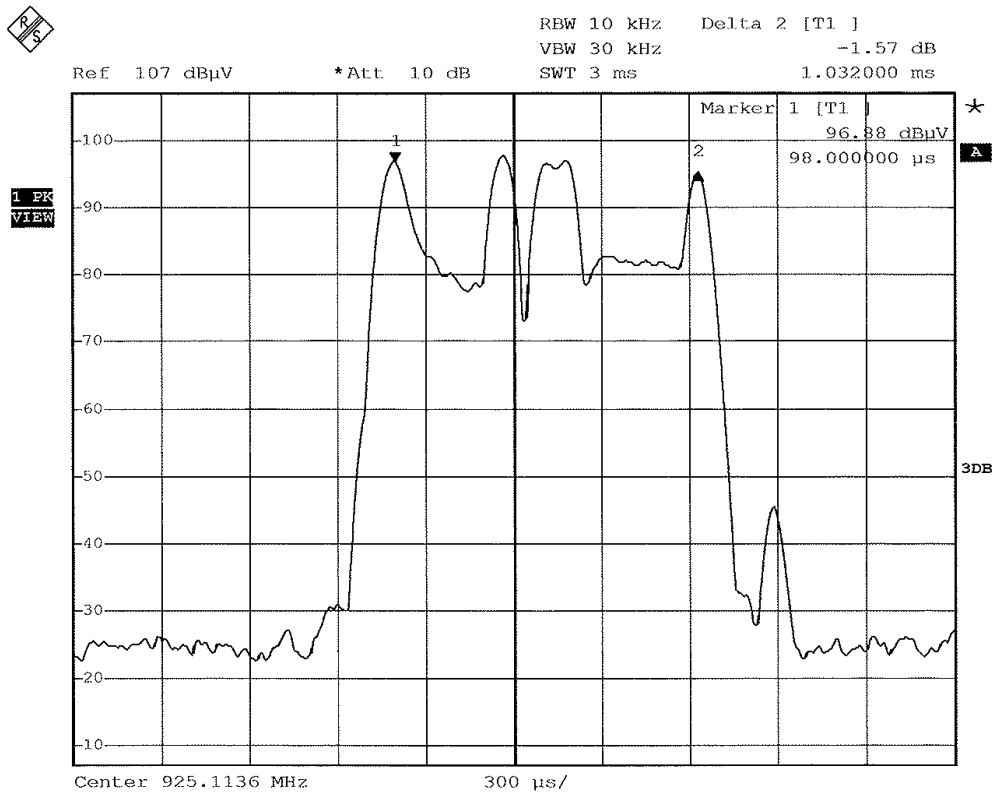
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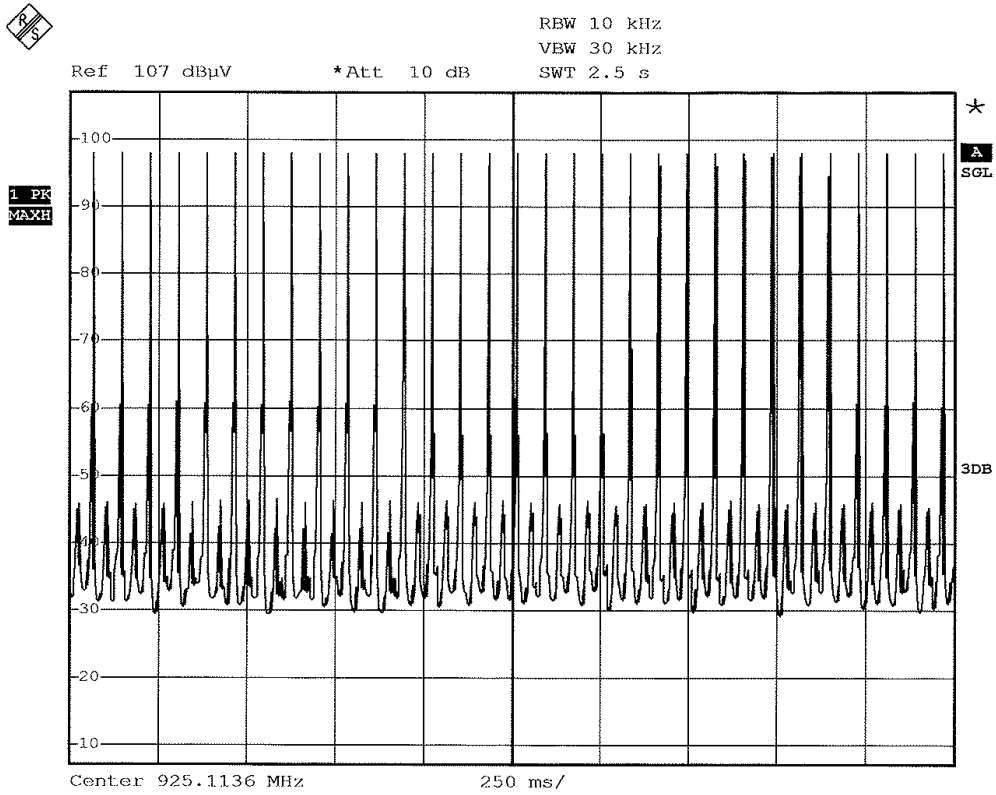
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Date: 8.OCT.2008 05:49:28



Date: 8.OCT.2008 05:46:01



Date: 8.OCT.2008 05:50:25

ANNEX 4: PHOTOS OF THE EQUIPMENT UNDER TEST

GENERAL VIEW



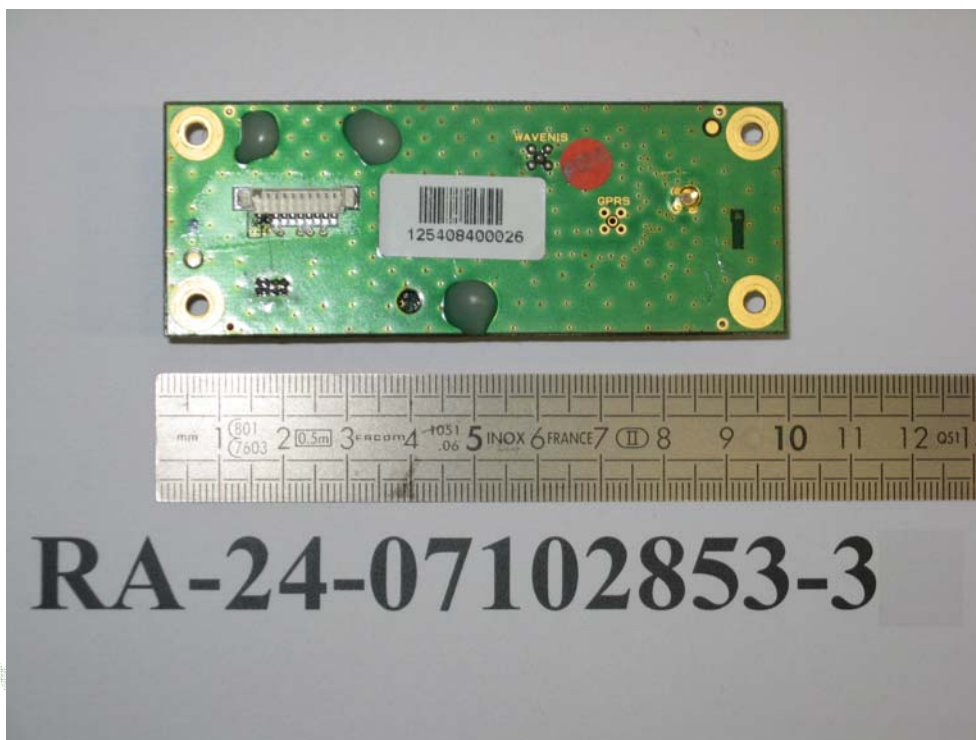
EMITECH

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Printed circuit board: face 1



Printed circuit board: face 2



Antenna



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ANNEX 5: TEST SET UP AND OPEN AREA TEST SITE

Test set up radiated measurement



Open area test site

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