

R051-24-09-105360-1/A Ed. 1

“This report cancels and replaces the test report N°R051-24-09-105360-1/A Edition 0”

FCC Certification RADIO measurement technical report Limited Modular Approval

**according to standard:
FCC Part 15**

**Equipment under test:
WAVECARD 915 MHZ MODULE**

**FCC ID:
XTL-MOD**

**Company:
OCEASOFT**

1 |

DISTRIBUTION: Mr RAMI

Company: CORONIS SAS

FOR TRANSMISSION TO: Mr ROUSSEAU

Company: OCEASOFT

Number of pages: 33 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.



PRODUCT: 915 MHz MODULE

Reference / model: Wavecard

Serial number: 13120960008A

MANUFACTURER: CORONIS SAS

COMPANY SUBMITTING THE PRODUCT:

Company: OCEASOFT

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DATE(S) OF TEST: 22 and 23 December 2009

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

TESTED BY: L. BERTHAUD

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1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment:
WAVECARD 915 MHZ MODULE in accordance with normative reference.

2. PRODUCT DESCRIPTION

Class: B (residential environment)

Utilization: 915 MHz module

Antenna type: dedicated antenna

Operating frequency range: from 907.0272 MHz to 921.3696 MHz

Number of channels: 51

Channel spacing: 56 kHz (minimum)

Frequency generation: ☐ SAW Resonator ☐ Crystal ☒ Synthesizer

Modulation: ☐ Amplitude ☐ Digital ☒ Frequency ☐ Phase

Power source: 5 Vd.c

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 (2008)	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 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 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

6.1 intentional radiator (subpart C)

Test procedure	Description of test	Respected criteria?				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 BAND 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) <i>hopping systems</i>	X				Note 3
	(a) (1) (i) 902 – 928 MHz	X				Note 4
	(a) (1) (ii) 5725 – 5850 MHz			X		
	(a) (1) (iii) 2400 – 2483.5 MHz			X		
	(a) (2) <i>digital modulation techniques</i>			X		
	(b) <i>maximum peak output power</i>	X				Note 5
	(c) <i>operation with directional antenna gains > 6 dBi</i>			X		Note 6
	(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 7
DA 00-705	BAND EDGE COMPLIANCE	X				

NAP: Not Applicable

NAs: Not Asked

Note 1: professionally installed equipment (declared by the applicant).

Note 2: see FCC part 15.247 (d).

Note 3: 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 25 kHz (see annex 1).

Note 4: the frequency hopping system uses 51 channels (see annex 2). The timing by channel is 1.14 ms. During 20 s, any channel is used 230 times, then $230 \times 1.14 \text{ ms} = 262.2 \text{ ms}$, thus the average time of occupancy on any channel is less than 400 ms within a period of 20 s (see annex 3).

Note 5: conducted measurement.

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

Note 7: 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

6.3 Conclusion:

The sample of WAVECARD 915 MHZ MODULE 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 (residential environment)

Standard deviation: For $F > 1\text{GHz}$, 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
Power source	Hewlett Packard E3610A	4195

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 $f = 921.3696\text{ MHz}$
According to § 15.33 of the FCC Part 15 standard, the frequency range measured is indicated in the following table:

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 40GHz, whichever is lower

Detection mode: Quasi-peak ($F < 1 \text{ GHz}$)
Average ($F > 1 \text{ GHz}$)

Bandwidth: 120 kHz ($F < 1 \text{ GHz}$)
1 MHz ($F > 1 \text{ GHz}$)

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 blocked in reception mode (which corresponds to the standby mode of the transmitter) by the mean of a software: test DLL protocol V17 (provided by the applicant).

Results:

Ambient temperature ($^{\circ}\text{C}$): 22.5
Relative humidity (%): 31

The equipment is supplied in 5 Vd.c by a stabilized power source.

Not any spurious has been detected.

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

TEST CONCLUSION:

RESPECTED STANDARD

8. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Power source E3610A	Hewlett Packard	4195
Meteo station	Oregon scientific	1539

Test set up:

The measure is realized in conducted mode.

The output power level is measured with a resolution bandwidth adjusted at 100 kHz (detector: Peak)

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, by the mean of a software: Test DLL protocol V17 (provided by the applicant).

Results:

Ambient temperature (°C): 18.5

Relative humidity (%): 48

The equipment is supplied in 5 Vd.c by a stabilized power source.

Sample n° 1 Channel 1 (907.0272 MHz)

	P* (W)	Limit (W)
Normal test conditions	0.7×10^{-3}	1

Sample n° 1 Channel 2 (913.9392 MHz)

	P* (W)	Limit (W)
Normal test conditions	0.8×10^{-3}	1

Sample n° 1 Channel 3 (921.3696 MHz)

	P* (W)	Limit (W)
Normal test conditions	0.6×10^{-3}	1

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
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 modulated transmission mode, by the mean of a software: Test DLL protocol V17 (provided by the applicant).

Results:

Ambient temperature (°C): 18.5
Relative humidity (%): 45

The equipment is supplied in 5 Vd.c by a stabilized power source.

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

Channel 1 (907.0272 MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1814.08	P	147	0	100	V	72.02	76.4	4.38

Channel 2 (913.9392 MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1827.87	P	149	0	100	V	72.32	76.4	4.08

Channel 3 (921.3696 MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1842.73	P	151	0	100	V	70.52	76.4	5.88

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

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 96.4 dBμV/m on channel 2.

So the applicable limit is 76.4 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)).

TEST CONCLUSION:

RESPECTED STANDARD

10. BAND EDGE COMPLIANCE

Standard: FCC Part 15.247

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

Test equipments:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Antenna RGA-60	Electrometrics	1204
Power source E3610A	Hewlett Packard	4195

Test set up:

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

Test operating condition of the equipment:

The equipment is blocked in frequency hopping mode by the mean of a software : Test DLL protocol V17 (provided by the applicant).

Results:

Lower Band Edge: from 900 MHz to 902 MHz (curve n°1)

Upper Band Edge: from 928 MHz to 930 MHz (curve n°2)

Sample n°1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (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)
907.0272	96.1	peak	901.696	48	48.1 (1)	73.98	25.88
921.3696	95.5	peak	928.182	48.22	47.28 (1)	73.98	26.7

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

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

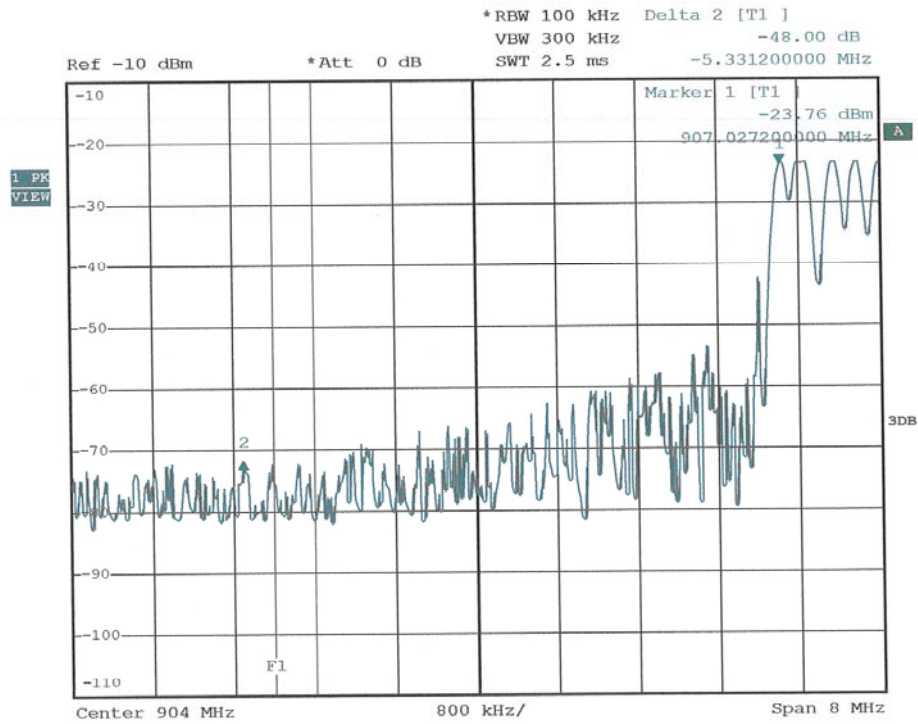
Calculated Emission Level = Field Strength Level – Delta Marker Level

(1) the peak level is lower than the average limit (53.98 dBμV/m).

Test conclusion:

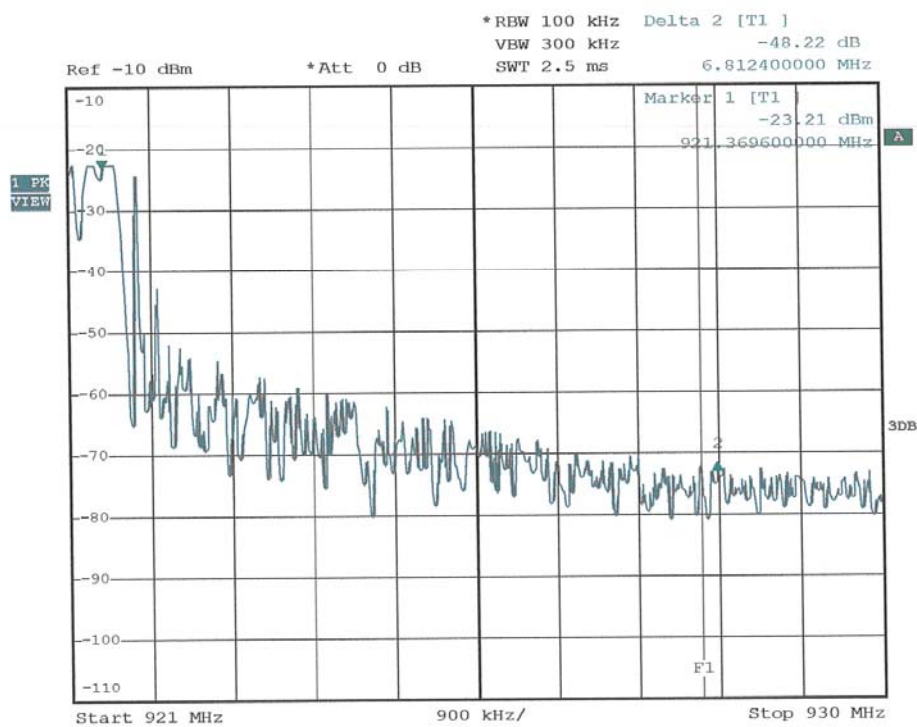
RESPECTED PUBLIC NOTICE

CURVE N°: 1.



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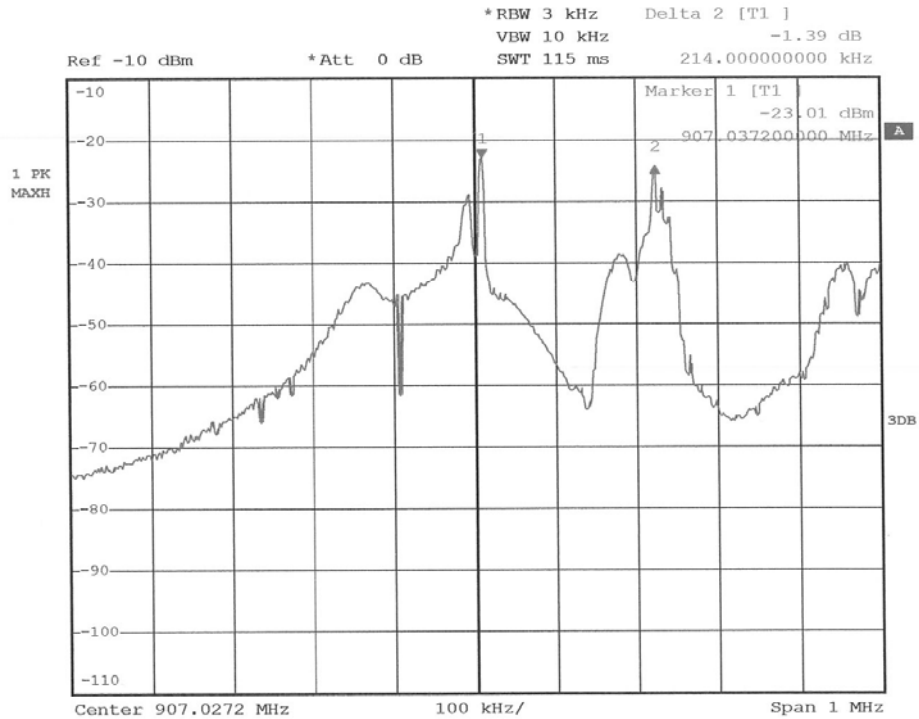
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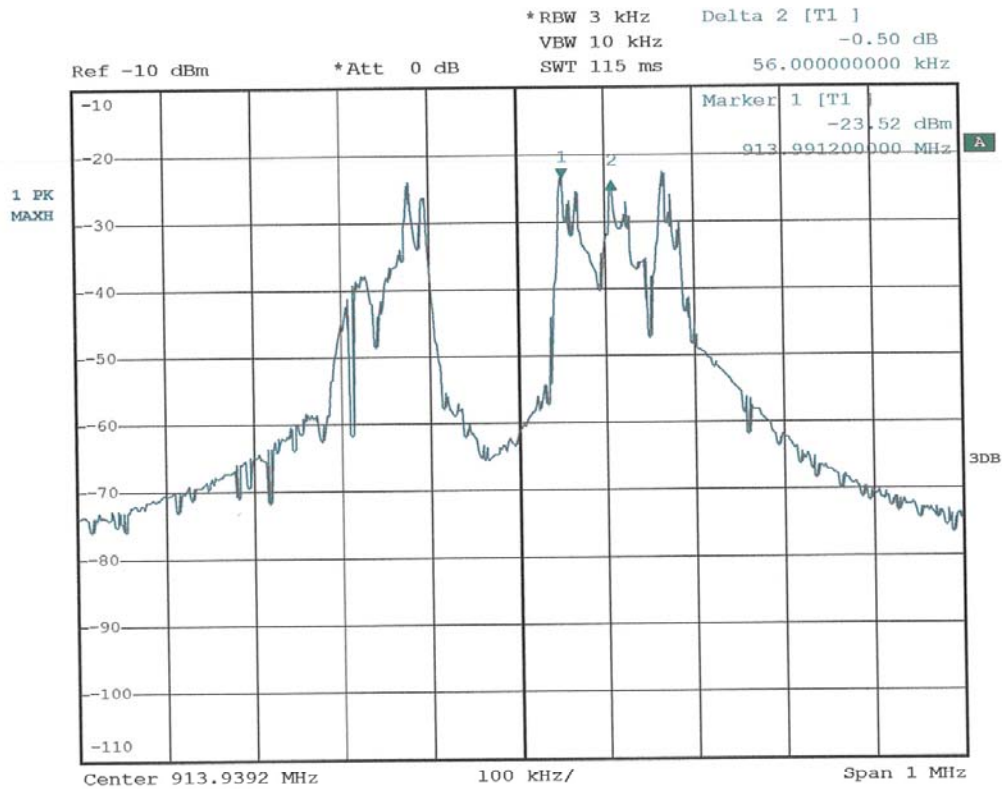
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□□□ End of report, 5 annexes to be forwarded □□□

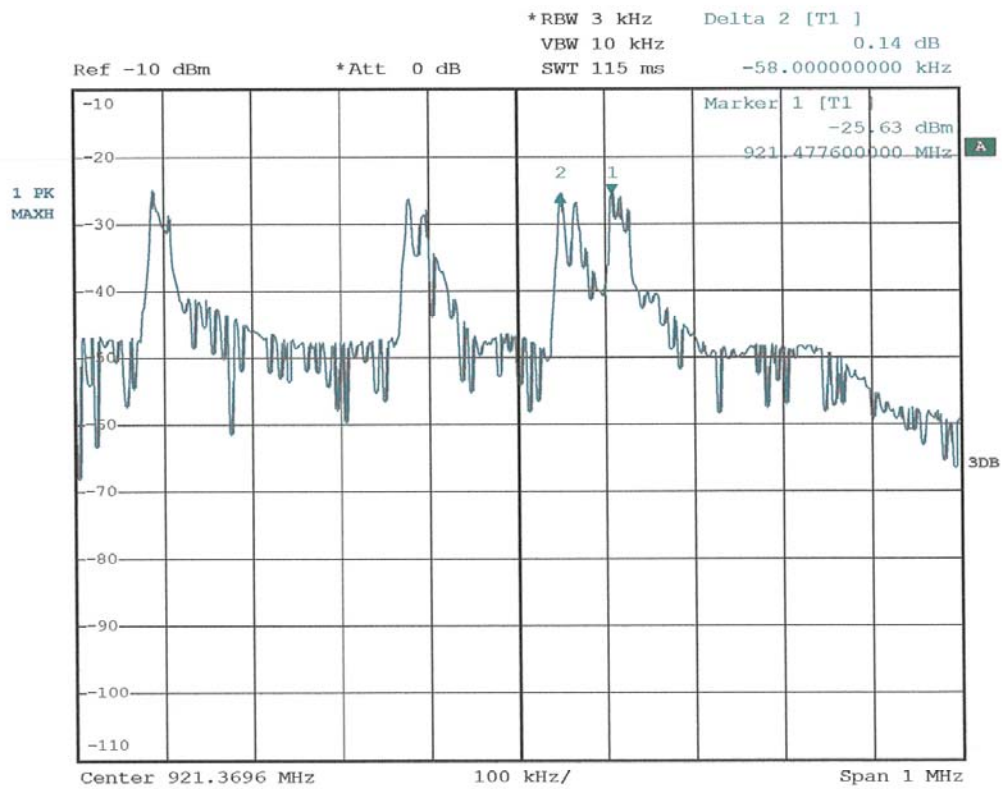
ANNEX 1: CHANNEL SEPARATION AND OCCUPIED POWER BANDWIDTH



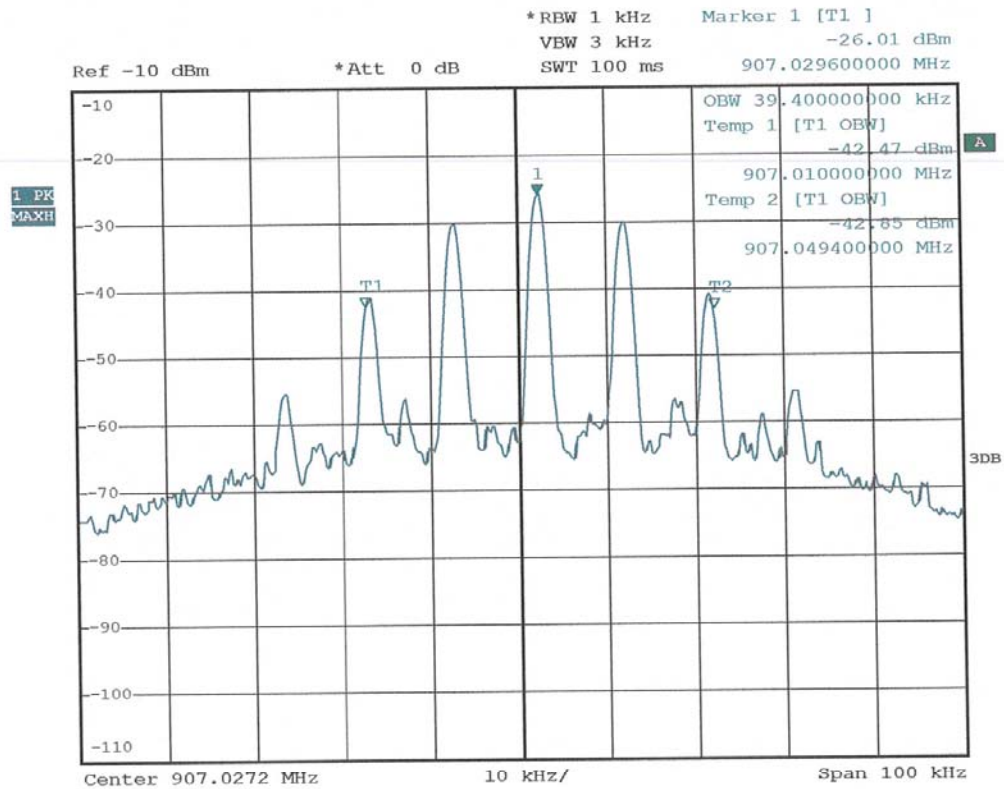
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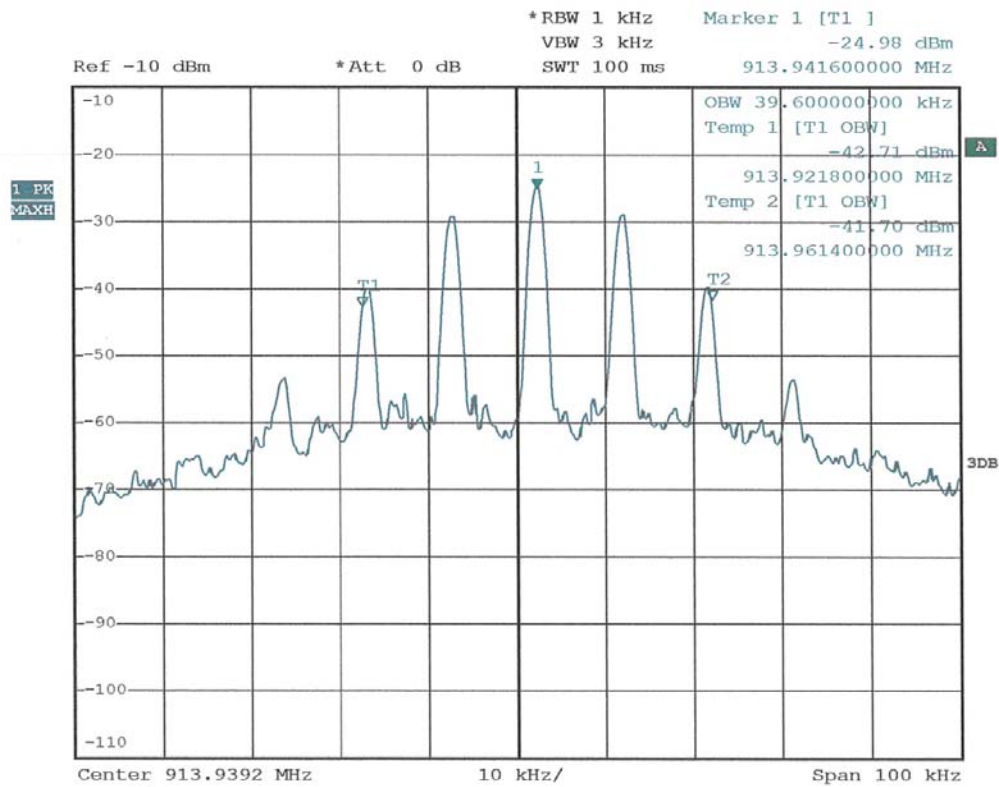
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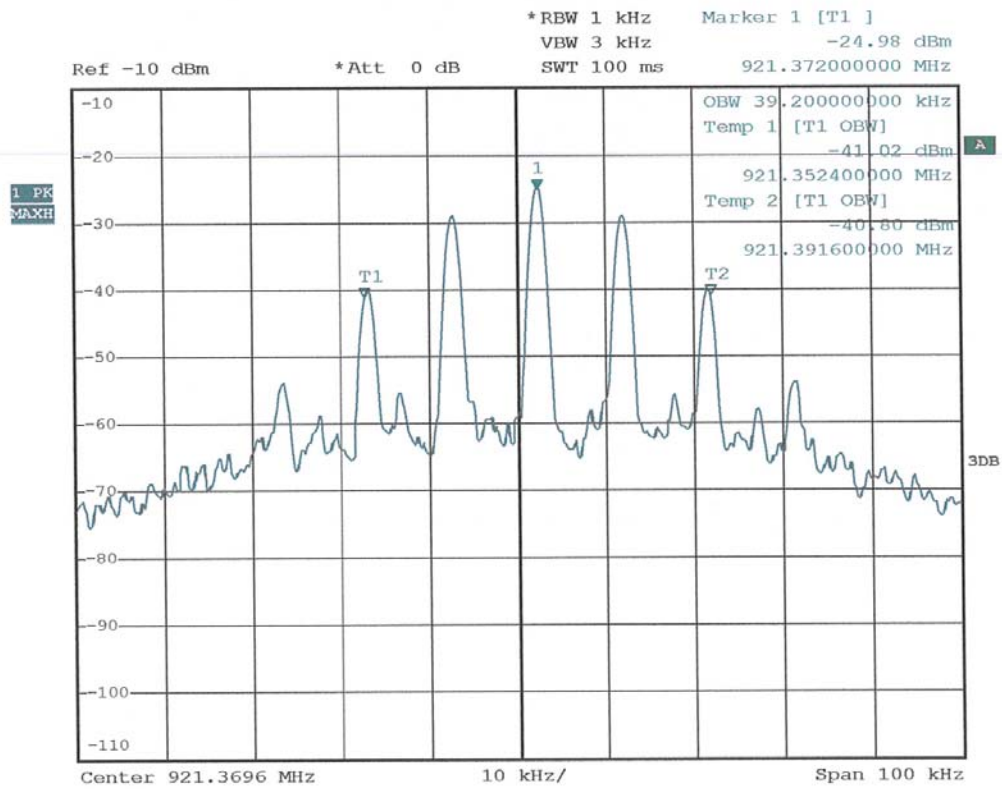
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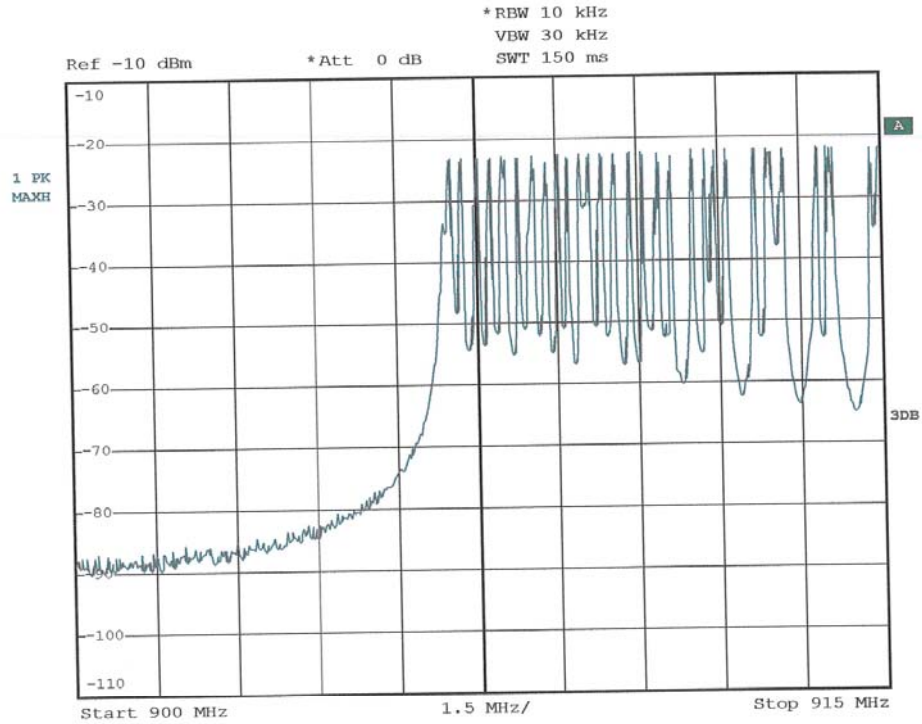


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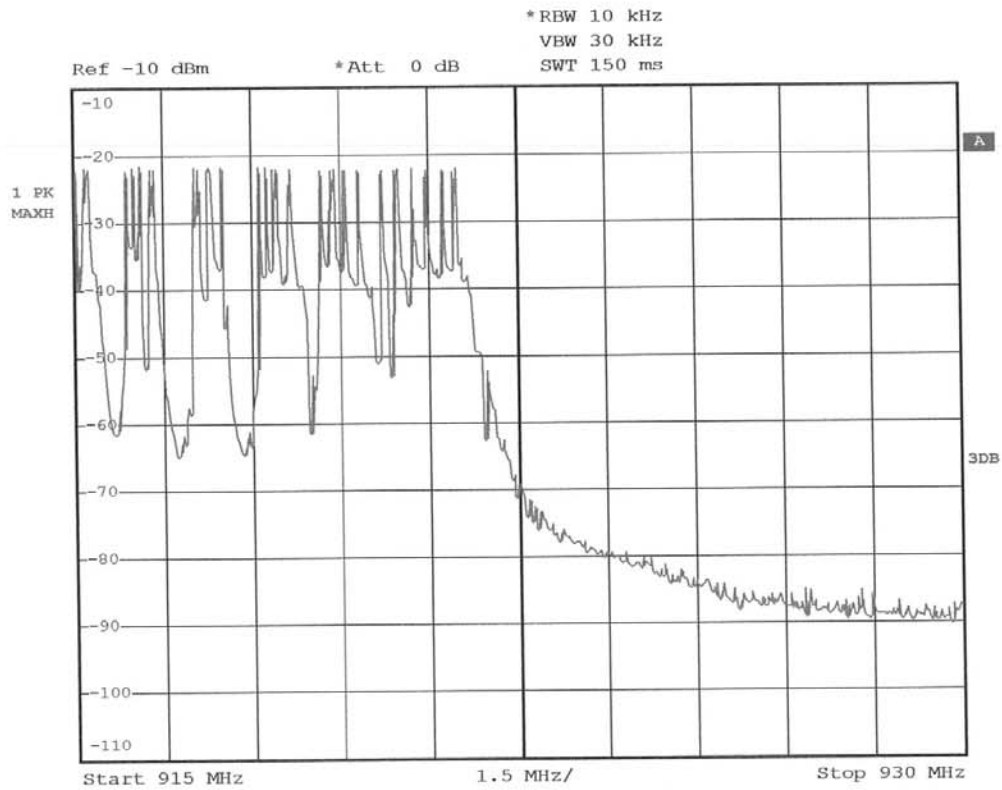


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ANNEX 2: NUMBER OF HOPPING FREQUENCIES

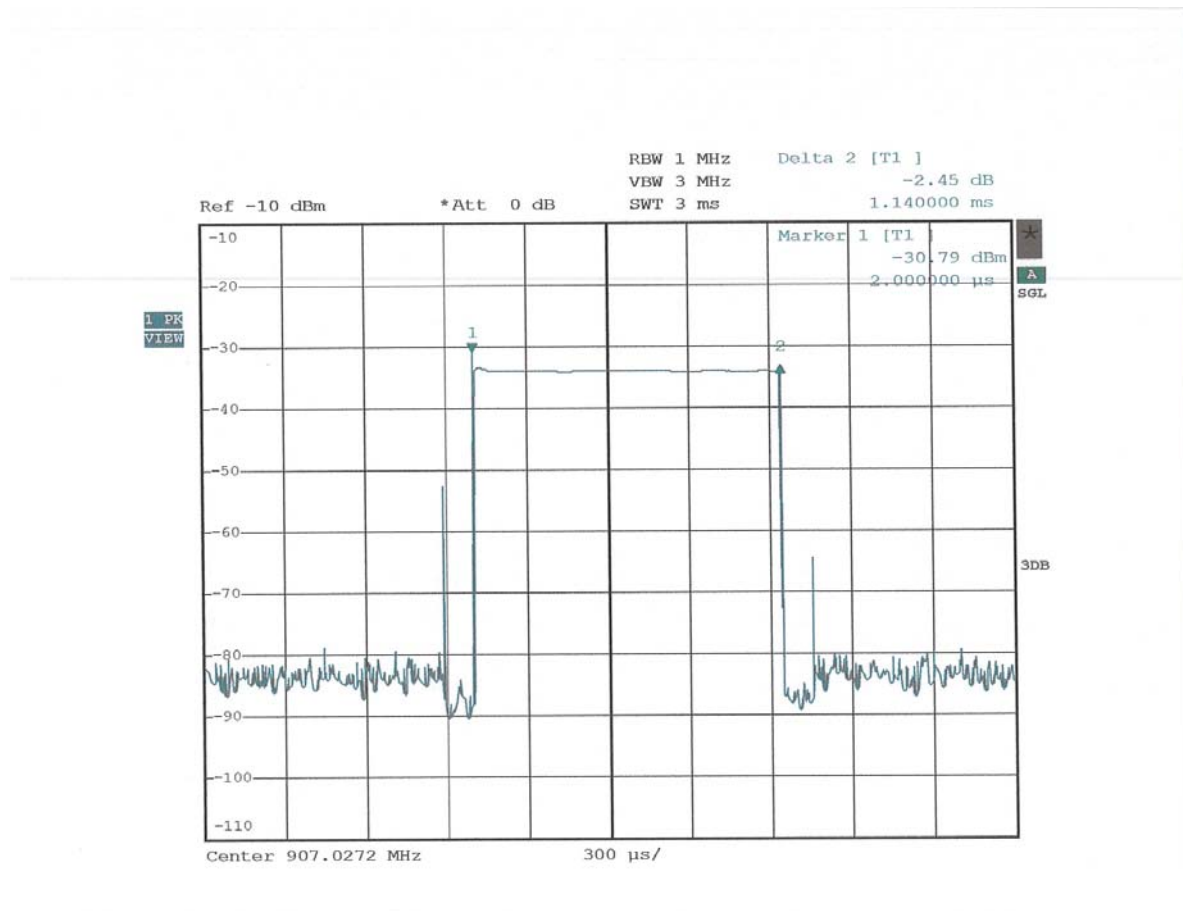


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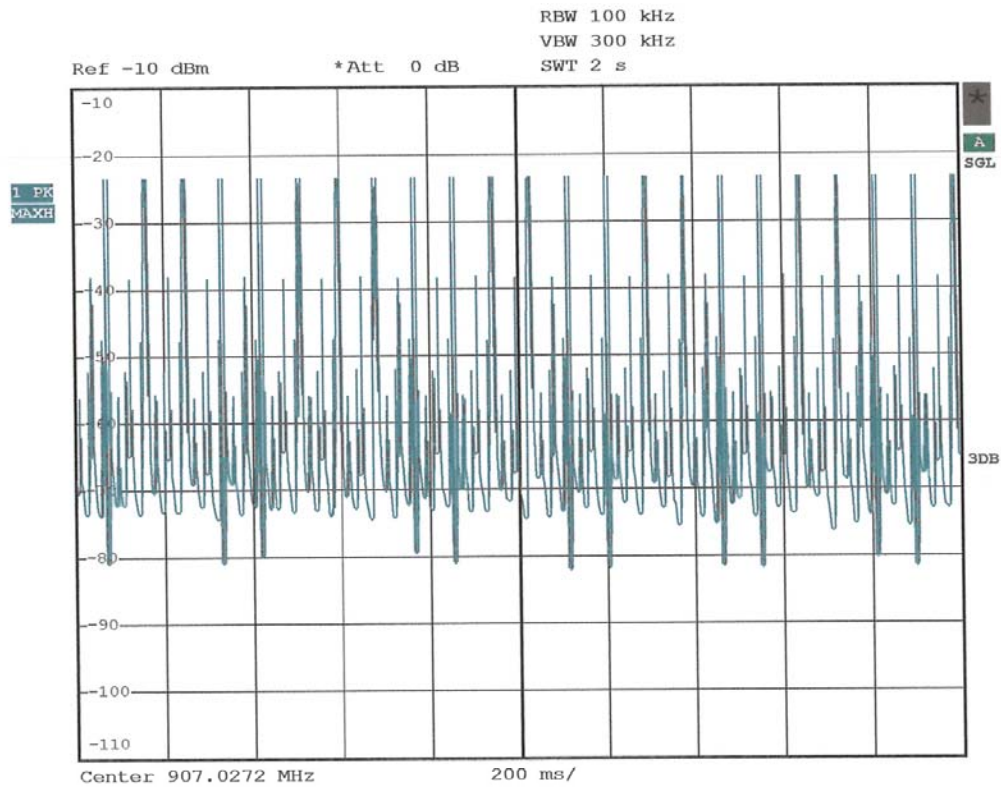


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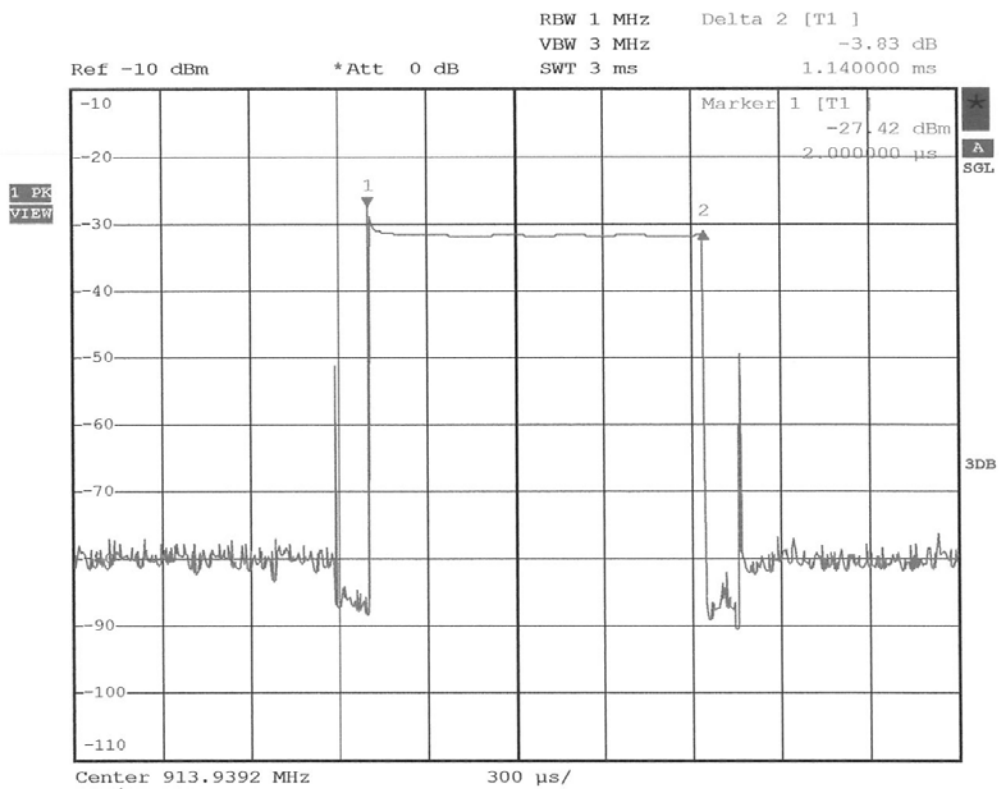
ANNEX 3: AVERAGE TIME OF OCCUPANCY ON ANY FREQUENCY



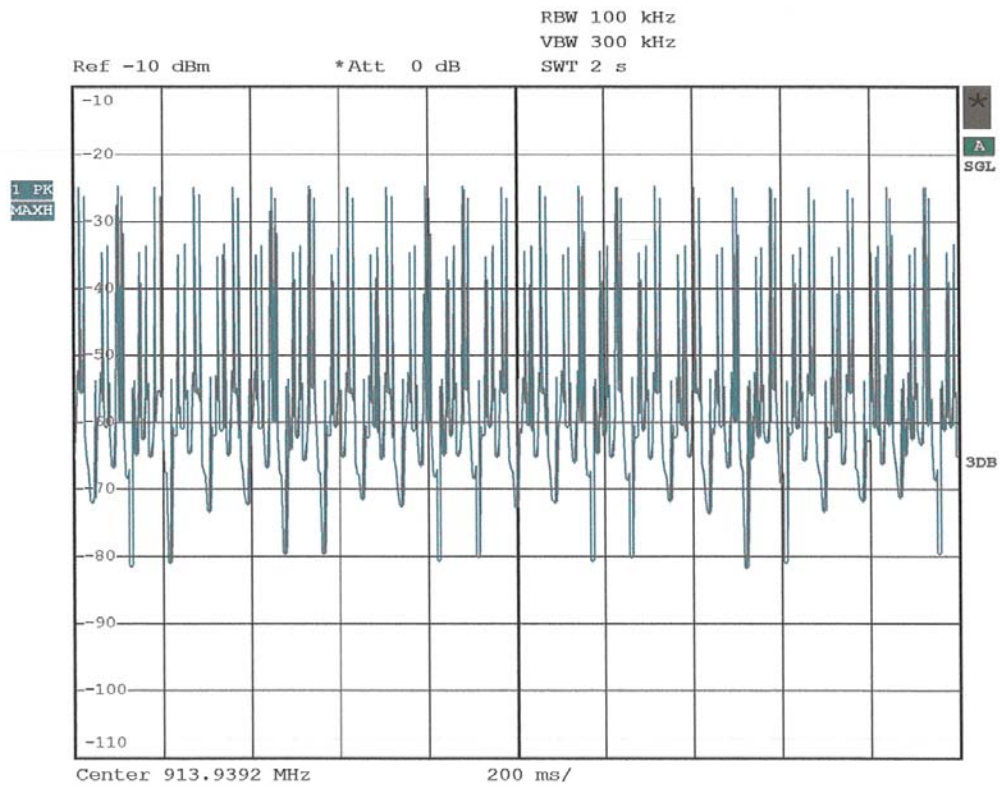
Date: 15.JAN.2010 05:49:06



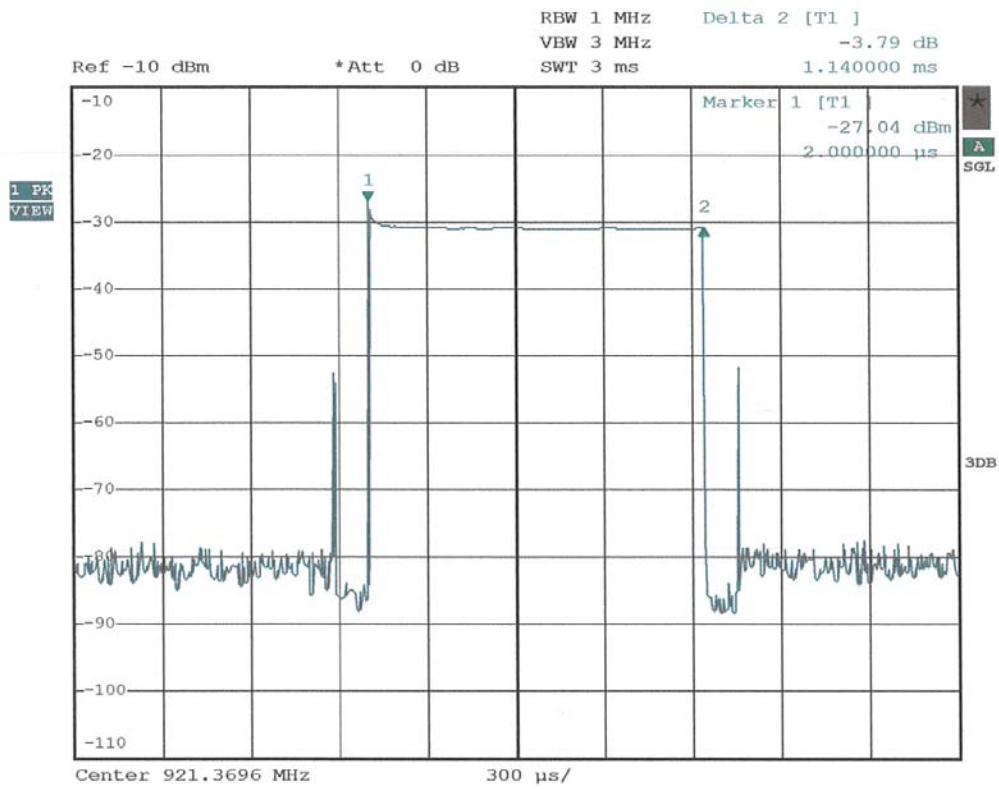
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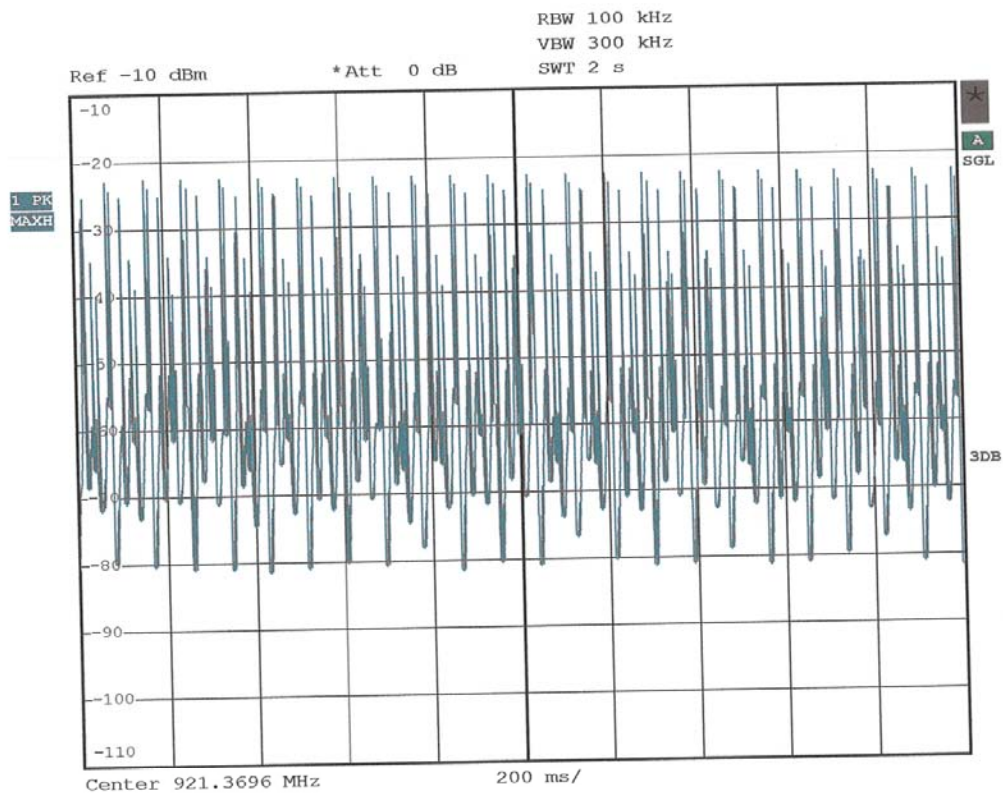
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Date: 15.JAN.2010 05:54:00



Date: 15.JAN.2010 05:55:00



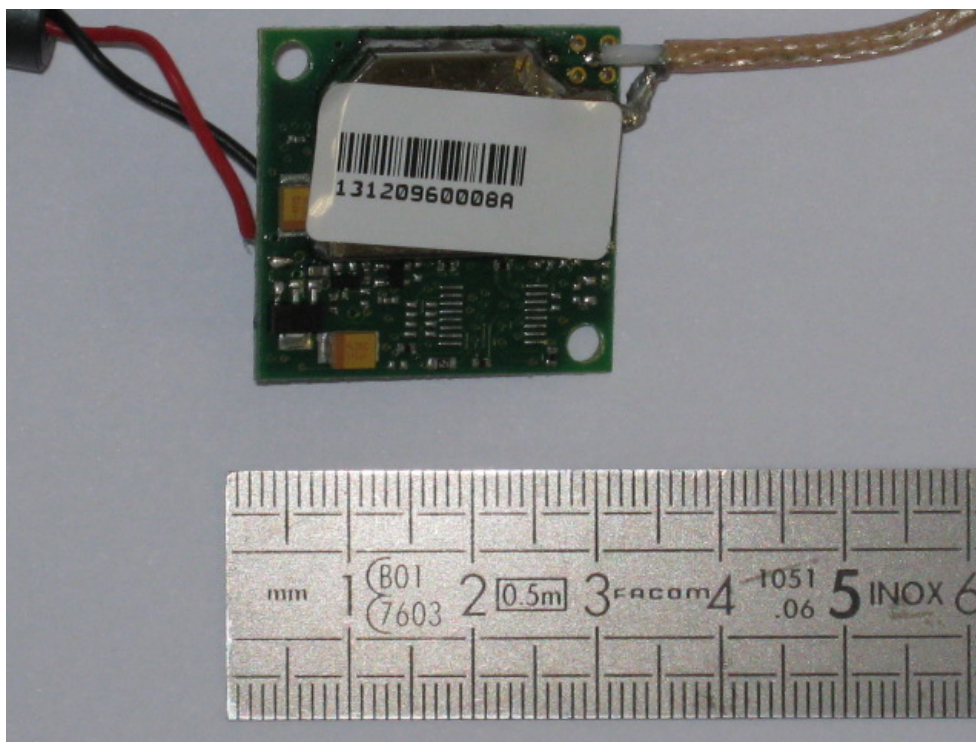
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ANNEX 4: PHOTOS OF THE EQUIPMENT UNDER TEST

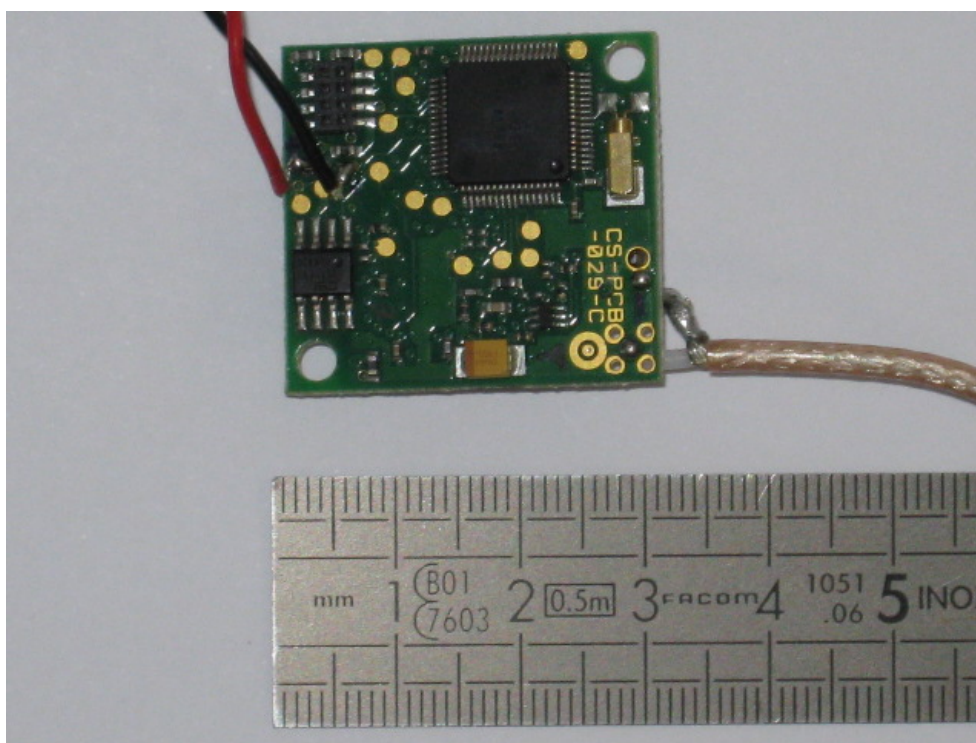
GENERAL VIEW



Printed circuit board: face 1



Printed circuit board: face 2



ANNEX 5: TEST SET UP

RADIATED MEASUREMENT

