R051-24-11-102887-1/A Ed. 0

RADIO test report

according to standard:
FCC Part 15

Equipment under test:
Data concentrator RTU + SERVER 2
FCC ID: VS7 RTUS2-WC

Company:
EnergyICT

DISTRIBUTION: Mr FAVOREL **Company: EnergyICT**

Number of pages: 46 including 7 annexes

Ed.	Date	Modified pages	Written by Name	Written by Visa	Technical Verification Quality Approval Name	Technical Verification Quality Approval Visa
0	22-Sep-11	Creation	L. BERTHAUD	LB	DUMESNIL M.	

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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:	**Data concentrator**
Reference / model:	RTU + Server 2
Serial number:	5100EE544B400002 (radio address)
MANUFACTURER:	EnergyICT

COMPANY SUBMITTING THE PRODUCT:

Company:	EnergyICT
Address:	Stasegemsesteenweg 112 8500 KORTRIJK BELGIUM
Responsible:	Mr FAVOREL
DATE(S) OF TEST:	23, 29 and 30 August 2011
TESTING LOCATION:	EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE EMITECH ATLANTIQUE open area test site in LA POUEZE (49) FRANCE FCC Registration Number: 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: RTU + Server 2 in accordance with normative reference.

The device integrates a GPRS module already certified (FCC ID: VW3HILONC).

2. PRODUCT DESCRIPTION

ITU Emission code:	160KF7D
Class:	B (residential environment)
Utilization:	Data concentrator collecting meter data over Wavenis RF network
Antenna type and gain:	6 dBd Fiberglass antenna (3.83 dBi)
Operating frequency range:	From 904.8384 MHz to 925.4592 MHz
Number of channels:	63
Channel spacing:	170 kHz
Frequency generation:	PLL
Modulation:	FSK
Power source:	120 Va.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 (2011)	Radio Frequency Devices
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:

Subpart B –Unintentional Radiators
- Paragraph 107: Conducted limits
- Paragraph 109: Radiated emission limits
- Paragraph 111: Antenna power conduction limits for receivers

Subpart C – Intentional Radiators
- Paragraph 203: Antenna requirement
- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements
- Paragraph 212: Modular transmitter
- Paragraph 215: Additional provisions to the general radiated emission limitations
- Paragraph 247: Operation within the bands 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz

5. TEST EQUIPMENT CALIBRATION DATES

Emitech number	Brand	Type	Last verification	Next verification	Validity
728	R&S 11966C	Biconical antenna	18/11/2008	18/11/2012	17/01/2013
812	Fluke 77-2	Multimeter	22/03/2011	22/03/2013	21/05/2013
834	PMM L3-25	LSIN	16/12/2009	16/12/2011	14/02/2012
1058	R&S ESH3	Test receiver	24/01/2011	24/01/2013	25/03/2013
1204	Electrometrics EM-6961	Guide antenna	30/05/2008	30/05/2012	29/07/2012
1219	R&S ESVS10	Test receiver	14/06/2011	14/06/2013	13/08/2013
1274	Emitech	OATS	28/01/2010	28/01/2012	28/03/2012
1406	Emco 6502	Loop antenna	13/01/2011	13/01/2013	14/03/2013
1419	Dereix R213	Variac	/	/	*
1999	R&S HL223	Logperiodic antenna	18/11/2008	18/11/2012	17/01/2013
2152	PROFLINE 2115-400	Power source	16/04/2010	16/04/2012	15/06/2012
2565	HP11947A	Transient limiter	03/02/2010	03/02/2012	03/04/2012
2648	Microwave DB97-1852	1-18 GHZ preamplifier	19/07/2011	19/07/2012	17/09/2012
3135	R&S NRV-Z5	Power sensor	26/01/2010	26/01/2012	26/03/2012
4088	R&S FSP40	Spectrum analyzer	16/12/2009	16/12/2011	14/02/2012
5071	R&S FSEA	Spectrum analyzer	05/07/2011	05/07/2013	03/09/2013
6796	R&S FSP7	Spectrum analyzer	01/08/2011	01/08/2013	30/09/2013
7310	Filtek 12/1200-5AA	High-pass filter	16/09/2009	16/09/2011	15/11/2011
8190	R&S NRVS	Powermeter	20/04/2011	20/04/2013	19/06/2013

** The equipment is not verified; instead, the output voltage is checked before each measurement with the calibrated multimeter.*

6. TESTS AND CONCLUSIONS

6.1 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.107	CONDUCTED LIMITS	X				Class B
FCC Part 15.109	RADIATED EMISSION LIMITS	X				Class B
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable NAs: Not Asked

6.2 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 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				*Note 3*
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) Hopping systems	X				*Note 4*
	(a) (2) Digital modulation techniques			X		
	(b) Maximum peak output power	X				
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density			X		
	(f) Hybrid system			X		
	(g) Frequency hopping requirements	X				
	(h) Frequency hopping intelligence	X				
	(i) RF exposure compliance	X				*Note 5*

NAp: Not Applicable NAs: Not Asked

Note 1: Dedicated antenna. Professionally installed equipment.

Note 2: See FCC part 15.247 (d).

Note 3: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

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 (160 kHz; see annex 2).

The frequency hopping system uses 63 channels (see annex 3).

The timing by channel is 1200 µs (see annex 4).

During 20 s, any channel is used 250 times (see annex 5), then 250 x 1200 µs = 300 ms, thus the average time of occupancy on any channel is less than 400 ms within a period of 20 seconds.

*Note 5: PSD=EIRP/(4*π*R²) -> 290.4 mW / 4* π * (20cm)² = 0.06 mW/cm²*
The equipment fulfills the requirements of power density for general population/uncontrolled exposure of FCC Part 1.1310.

Conclusion:

The sample of RTU + Server 2 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 15.107

Limits: Class B

Test equipments:

TYPE	BRAND	EMITECH NUMBER
AC Power supply Profline 2115-400	Schaffner	2152
Test receiver ESH3	Rohde & Schwarz	1058
Spectrum analyzer FSEA	Rohde & Schwarz	5071
Artificial main network L3-25	PMM	0834
Transient limiter 11947A	Hewlett Packard	2565
Meteo station 608-H1	Testo	7565

Software used: BAT-EMC V3.5.0.2

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.
The equipment is powered with the AC power operating voltage of 120 V / 60 Hz.

See photos in annex 7.

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak

Bandwidth: 10 kHz

Equipment under test operating condition:

The equipment is blocked in standby / reception mode.

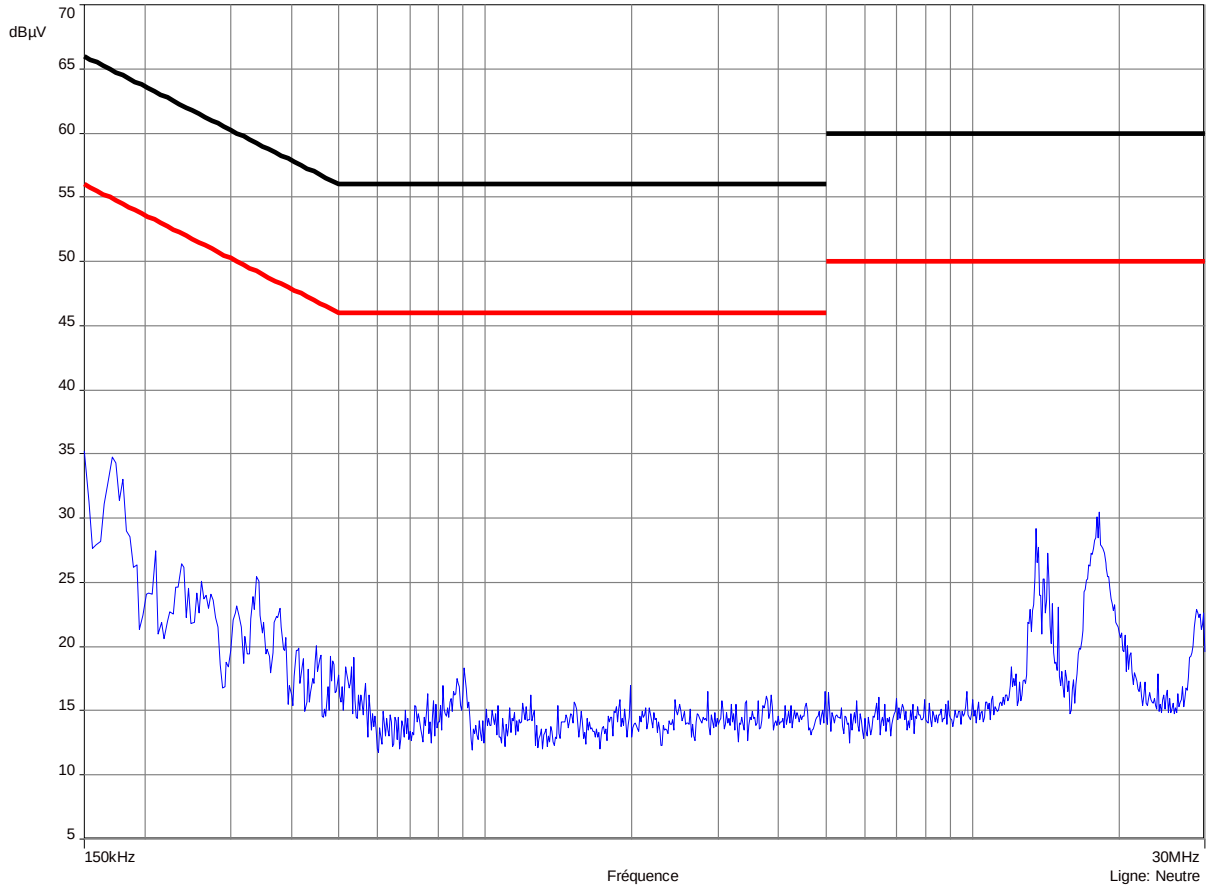
Results:

Ambient temperature (°C): 24
Relative humidity (%): 48

Measurement on the mains power supply:

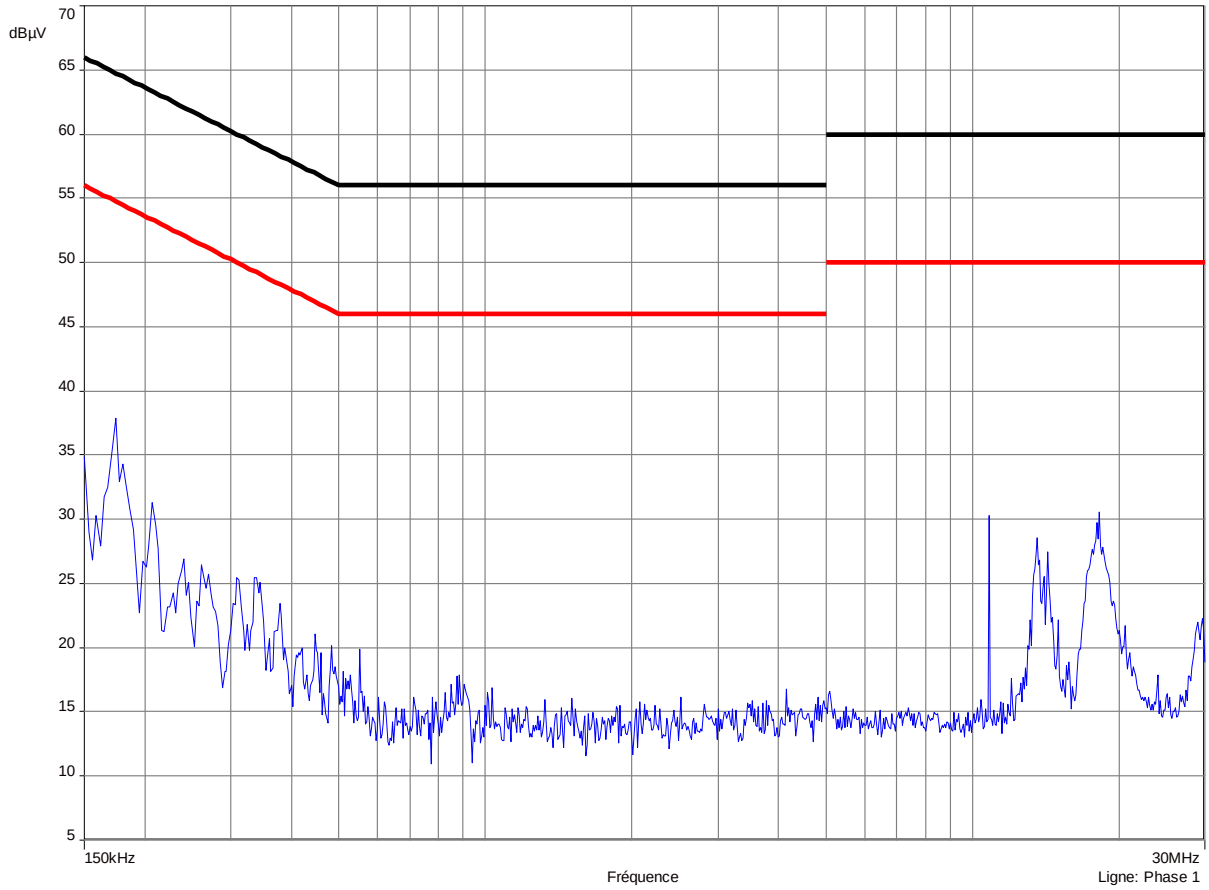
The measurement is first realized with Peak detector.

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

Test conclusion:

RESPECTED STANDARD

8. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class B

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Test receiver ESVS10	Rohde & Schwarz	1219
Spectrum analyzer FSP7	Rohde & Schwarz	6796
Biconical antenna 11966 C	Hewlett Packard	0728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Double ridged guide antenna EM 6961	Electrometrics	1204
Preamplifier 1 to 18 GHz DB97-1852	DBS Microwave	2648
High pass filter HPM11630	Micro-tronics	7310
Open area test site	Emitech	1274
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station meteostar	Bioblock Scientific	0943

Test set up:

The system is tested in an open area test site (OATS). The test unit is placed on a rotating table, 0.8m from a ground plane. Zero degree azimuths correspond to the front of the device under test.

See photos in annex 7.

Frequency range: From 30 MHz to 5000 MHz.

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's radio functions are blocked in standby / reception mode.

Results:

Ambient temperature (°C): 19
Relative humidity (%): 43

Power source: 120 Va.c. through a variac

Not any spurious has been detected.

Applicable limits: for 30 MHz ≤ F ≤ 88 MHz : 40 dBµV/m at 3 meters
for 88 MHz < F ≤ 216 MHz : 43.5 dBµV/m at 3 meters
for 216 MHz < F ≤ 960 MHz : 46 dBµV/m at 3 meters
Above 960 MHz : 54 dBµV/m at 3 meters

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

Test conclusion:

RESPECTED STANDARD

9. MEASUREMENT OF THE CONDUCTED DISTURBANCES

Standard: FCC Part 15

Test procedure: Paragraph 15.207

Test equipments:

TYPE	BRAND	EMITECH NUMBER
AC Power supply Profline 2115-400	Schaffner	2152
Test receiver ESH3	Rohde & Schwarz	1058
Spectrum analyzer FSEA	Rohde & Schwarz	5071
Artificial main network L3-25	PMM	0834
Transient limiter 11947A	Hewlett Packard	2565
Meteo station 608-H1	Testo	7565

Software used: BAT-EMC V3.5.0.2

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.
The equipment is powered with the AC power operating voltage of 120 V / 60 Hz.

See photos in annex 7.

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak / Average

Bandwidth: 10 kHz / 9 kHz

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

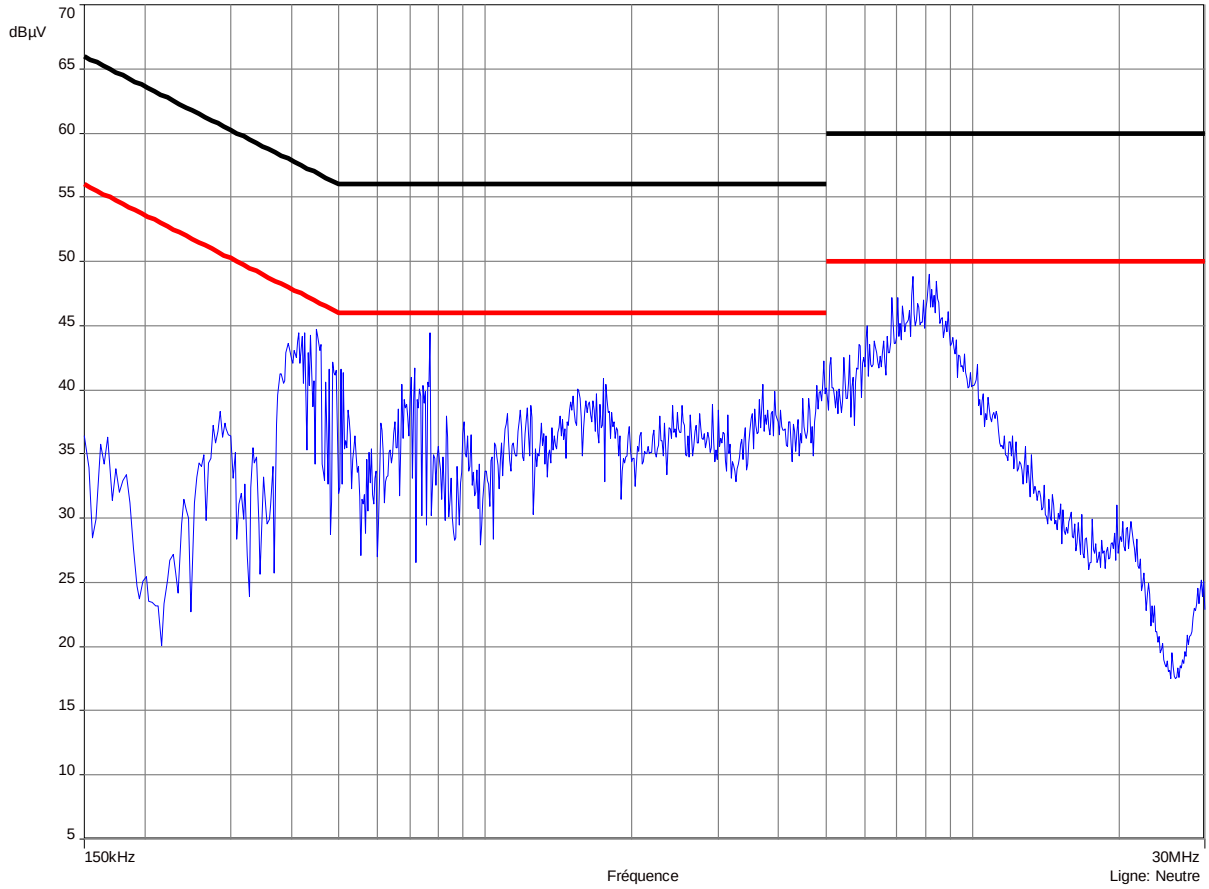
Results:

Ambient temperature (°C): 24
Relative humidity (%): 48

Measurement on the mains power supply:

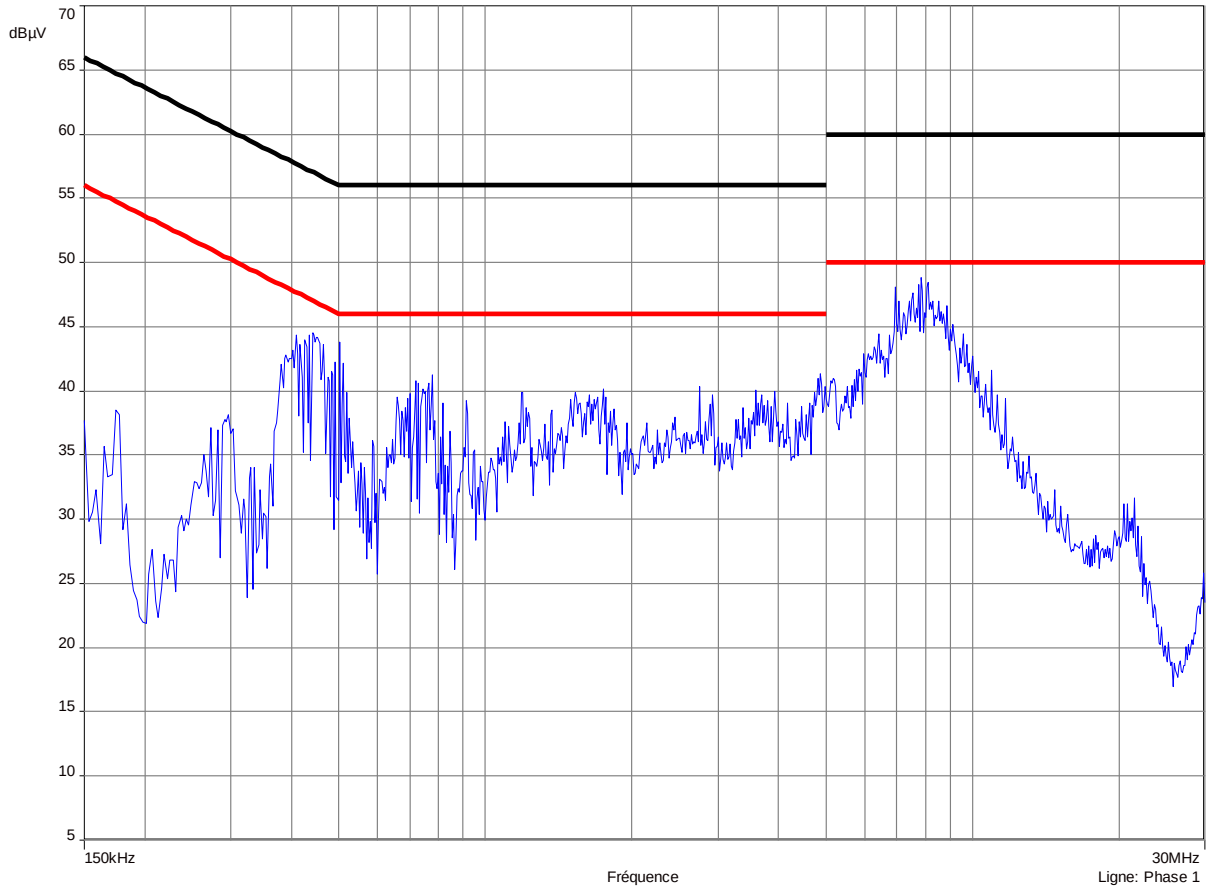
The measurement is first realized with Peak detector.

Curve N° 3: measurement on the Neutral with peak detector



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

Curve N° 4: measurement on the Line with peak detector



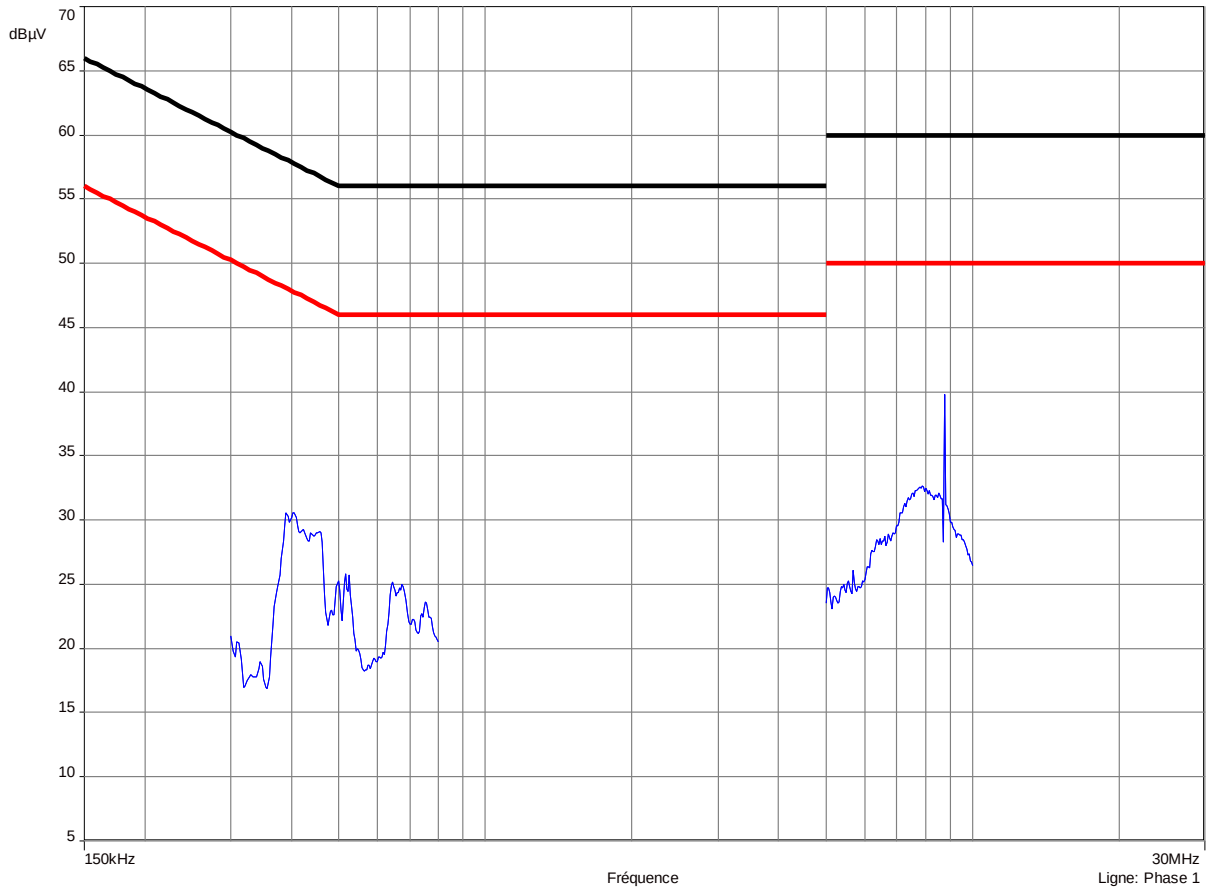
RBW filter: 10 kHz
VBW filter: 10 kHz
Sweep time: 500 ms/MHz

The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Curve N° 5: average measurement on the Neutral, for the frequency ranges 300 kHz – 800 kHz and from 5 MHz – 10 MHz

RBW filter: 9 kHz
Sweep time: 500 ms/MHz

Curve N° 6: average measurement on the Line, for the frequency ranges 300 kHz – 800 kHz and from 5 MHz – 10 MHz



RBW filter: 9 kHz
Sweep time: 500 ms/MHz

Test conclusion:

RESPECTED STANDARD

10. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Standard: FCC Part 15

Test procedure: Paragraph 15.215

Test equipments:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP7	Rohde & Schwarz	6796
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station AB888	Oregon Scientific	1539

Test set up:

Test realized in conducted mode on the devices antenna connector.

Test operating condition of the equipment:

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 (%): 43

Lower Band Edge: 902 MHz
Upper Band Edge: 928 MHz

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)
904.8384	110	P	901.04	45.2	64.8	90	25.2
925.4592	109.9	P	928.88	44	65.9	89.9	24

* *Marker-Delta method*

The band edge plots are given in annex 1.

The 20 dB bandwidth plots are given in annex 2.

Test conclusion:

RESPECTED STANDARD

11. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP7	Rohde & Schwarz	6796
Power meter NRVS	Rohde & Schwarz	8190
Power sensor NRV-Z5	Rohde & Schwarz	3135
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station AB888	Oregon Scientific	1539

Test set up:

The measure is realized in conducted mode with a calibrated peak power responding power meter.

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 19
Relative humidity (%): 43

Power source: 120 Va.c. through a variac

Sample n° 1 Lowest channel

	Conducted power (mW)	Limit (mW)
Normal test conditions	114.8	1000

Central channel

	Conducted power (mW)	Limit (mW)
Normal test conditions	120.2	1000

Highest channel

	Conducted power (mW)	Limit (mW)
Normal test conditions	107.2	1000

Test conclusion:

RESPECTED STANDARD

12. INTENTIONAL RADIATOR

Standard: FCC Part 15

Test procedure: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Test receiver ESH3	Rohde & Schwarz	1058
Test receiver ESVS10	Rohde & Schwarz	1219
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna 11966 C	Hewlett Packard	0728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Double ridged guide antenna EM 6961	Electrometrics	1204
Preamplifier 1 to 18 GHz DB97-1852	DBS Microwave	2648
High pass filter HP 12/1200-5AA	Filtek	7310
Open area test site	Emitech	1274
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station meteostar	Bioblock Scientific	0943

Test set up:

The system is tested in an open area test site (OATS). The test unit is placed on a rotating table, 0.8m from a ground plane. Zero degree azimuths correspond to the front of the device under test.

See pictures in annex 7.

Frequency range: From 9 kHz to 10^{th} harmonic of the highest fundamental frequency (925.4592 MHz).

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

Bandwidth: 120 kHz (F < 1 GHz) 100 kHz / 1 MHz (F > 1 GHz)

Distance of antenna: 3 / 10 meters (F ≤ 30 MHz)

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, at the highest output power level at which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 18.5
Relative humidity (%): 61

Power source: 120 Va.c. through a variac

Sample n° 1

Lowest channel (904.8384 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)
1809.7	P	110	270	100	V	64.4	90	25.6
2714.5	Av	120	140	1000	V	31.9	54*	22.1
2714.5	P	120	140	1000	V	56.1	74*	17.9
3619.3	P	165	0	1000	V	49.9	74*	24.1

Central channel (915.3216 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)
1830.6	P	105	270	100	V	65.7	90.1	24.4
2746	Av	120	145	1000	V	32.4	54*	21.6
2746	P	120	145	1000	V	56.3	74*	17.7
3661.3	P	170	0	1000	V	51.1	74*	22.9

Highest channel (925.4592 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)
1850.9	P	110	260	100	V	65.2	89.9	24.7
2776.3	Av	110	150	1000	V	32	54*	22
2776.3	P	110	150	1000	V	56.1	74*	17.9
3701.8	P	170	0	1000	V	51.4	74*	22.6

* restricted bands of operation in 15.205. If peak levels detected are below relevant average limit, the measure is not repeated with average detector.

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 110.1 dBµV/m on central channel.

So the applicable limit is 90.1 dBµV/m.

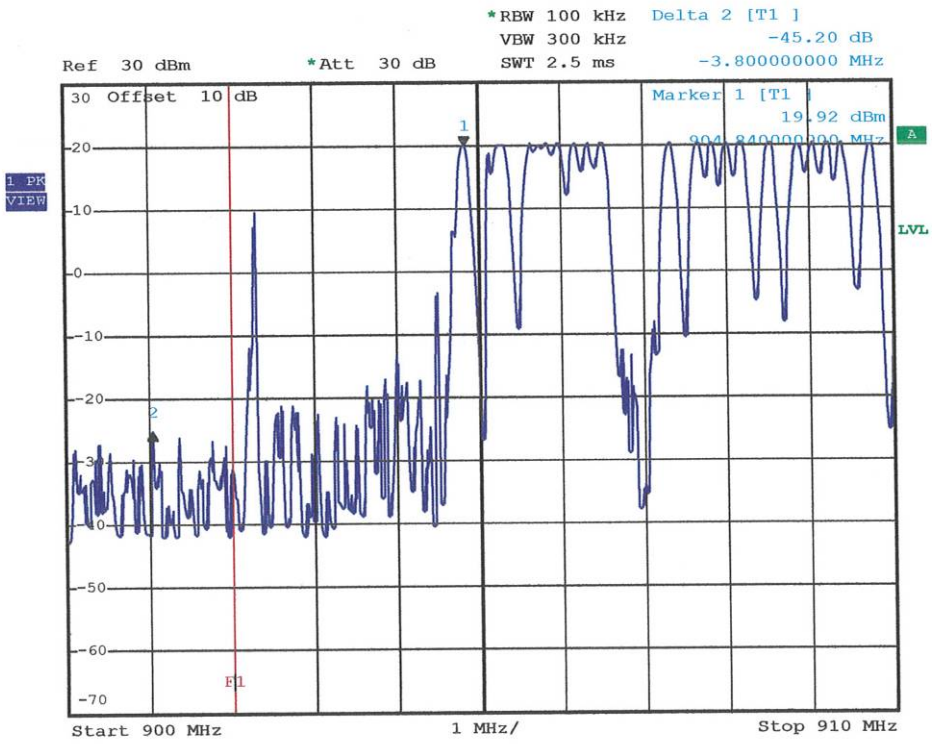
In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

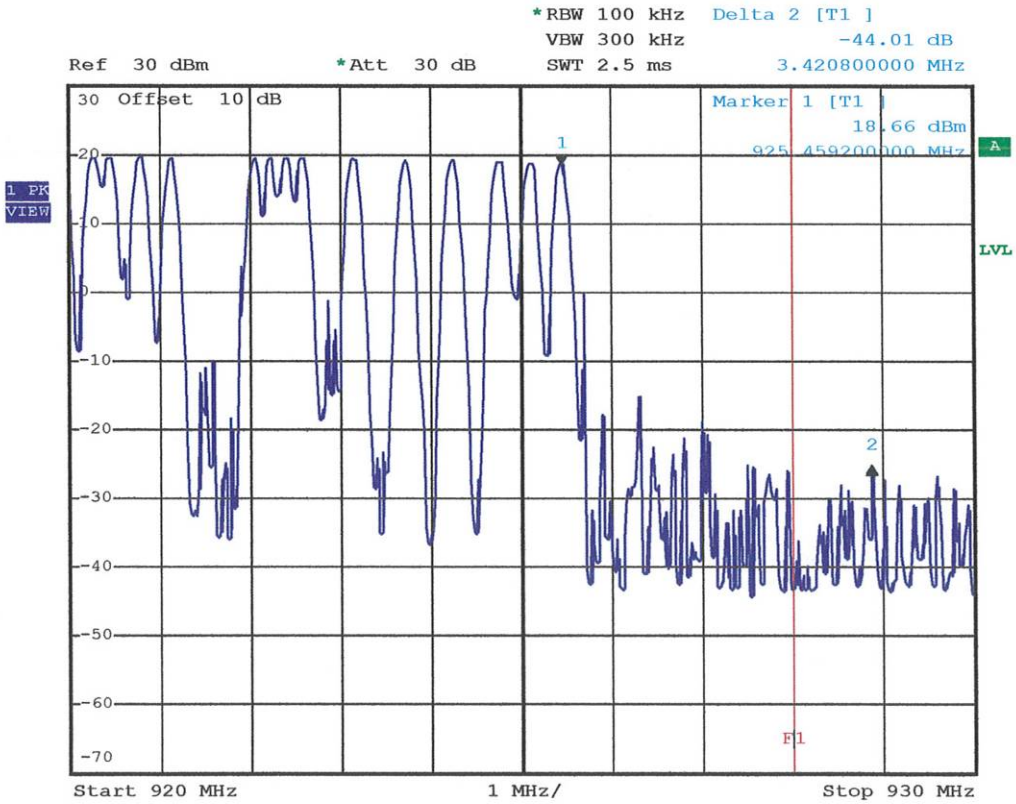
Test conclusion:

RESPECTED STANDARD

□□□ End of report, 7 annexes to be forwarded □□□

ANNEX 1: BAND-EDGE COMPLIANCE





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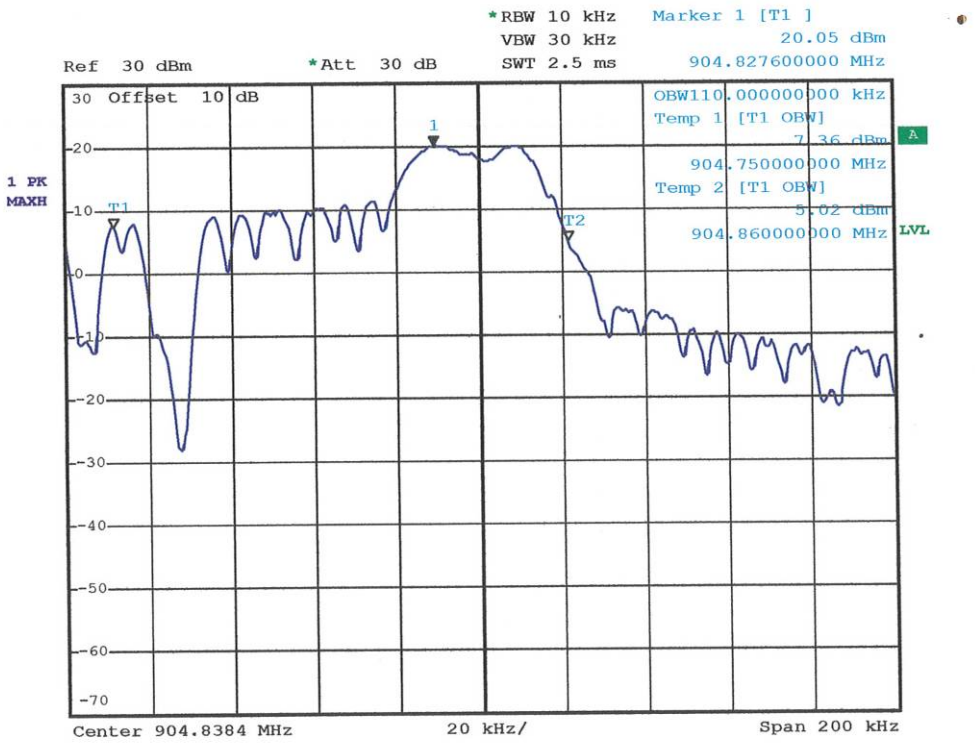
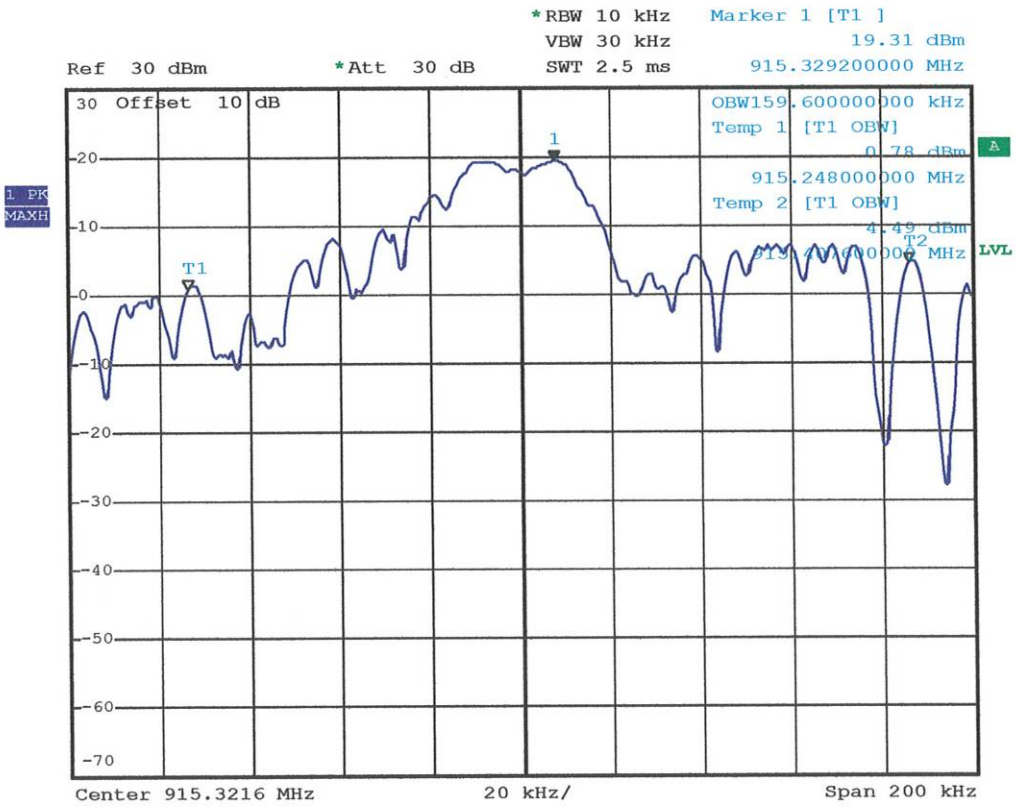
ANNEX 2: OCCUPIED BANDWIDTH AND CHANNEL SEPARATION





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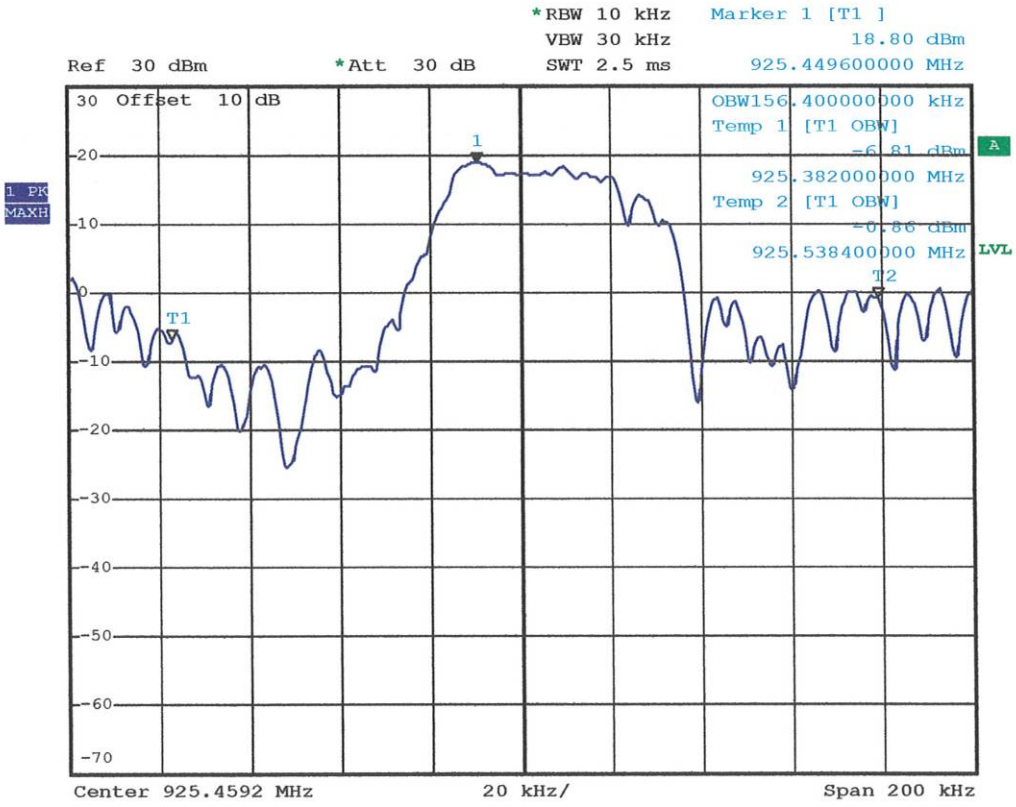

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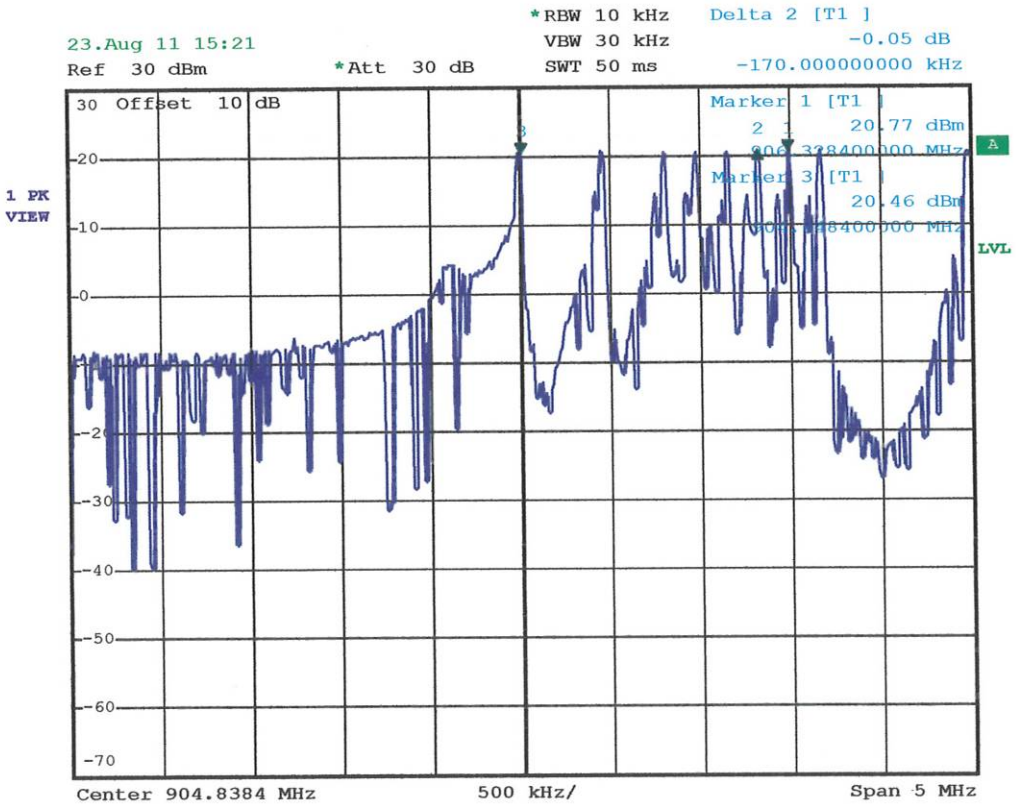

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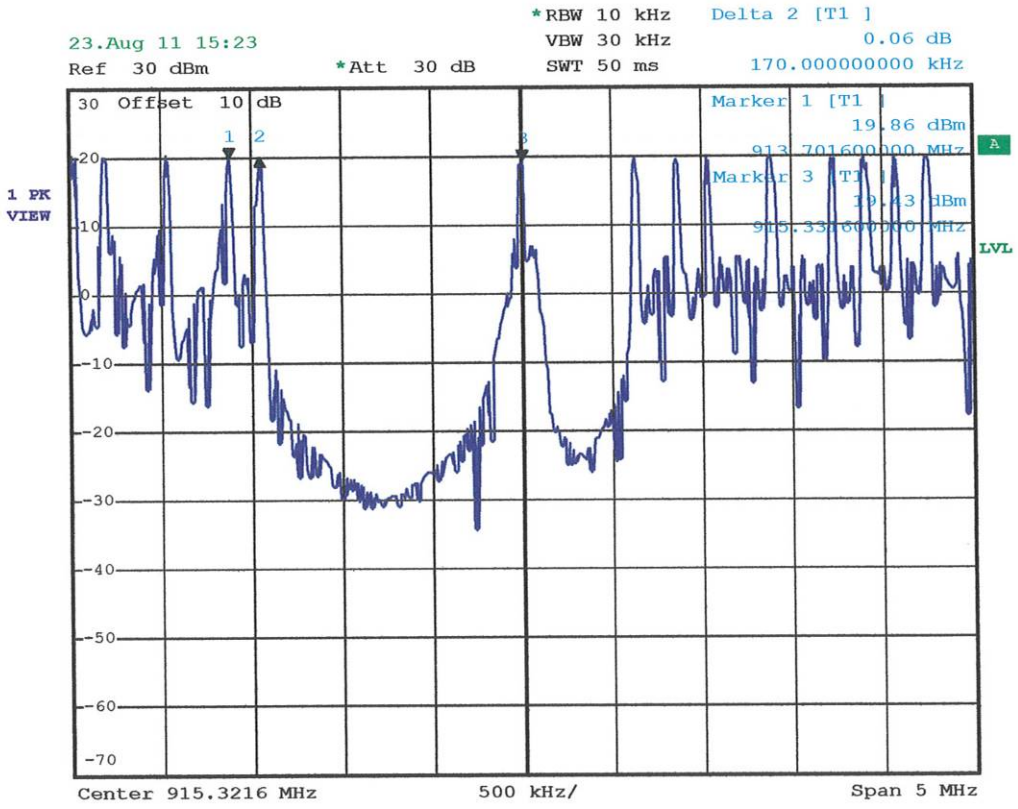

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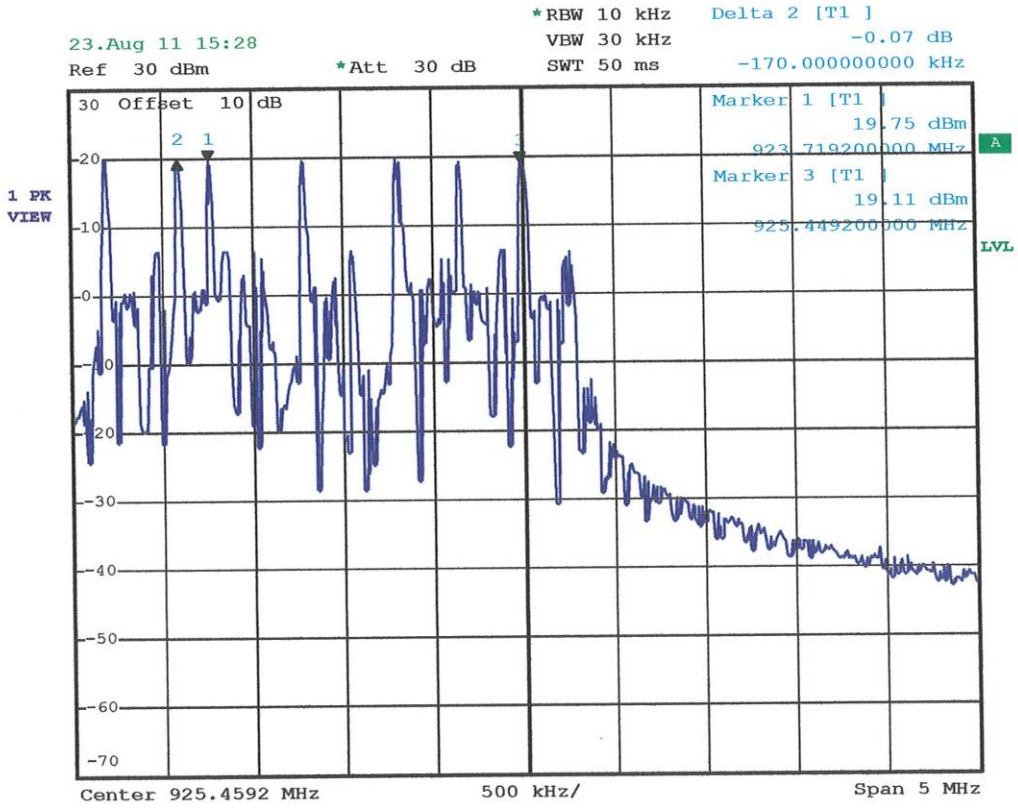
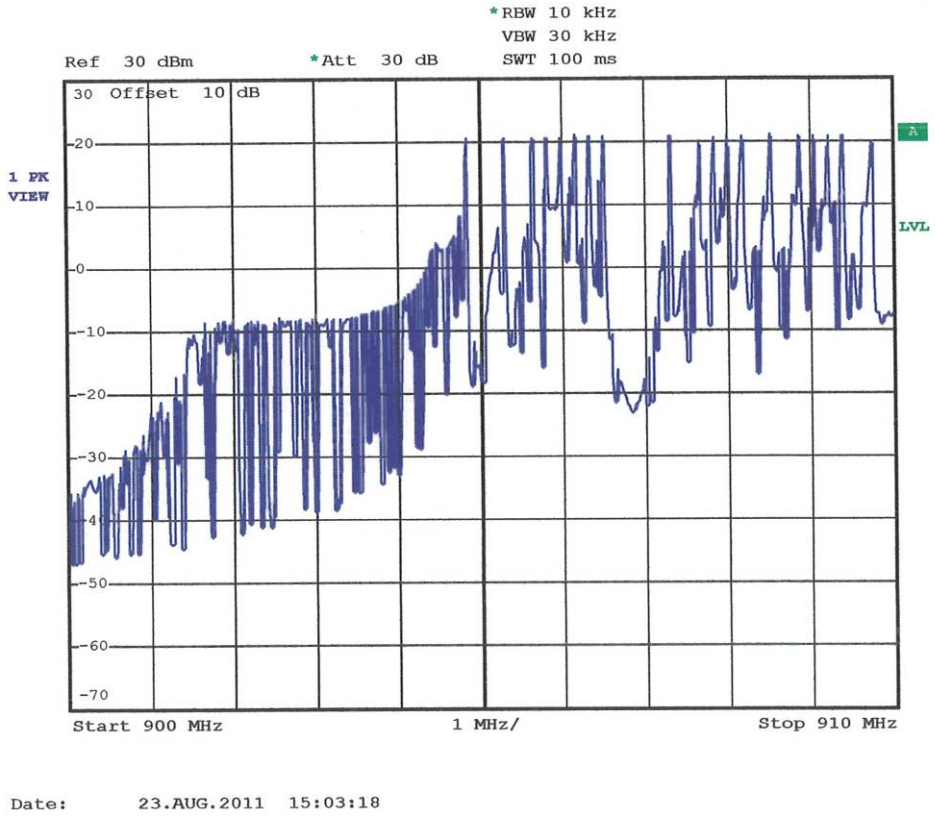
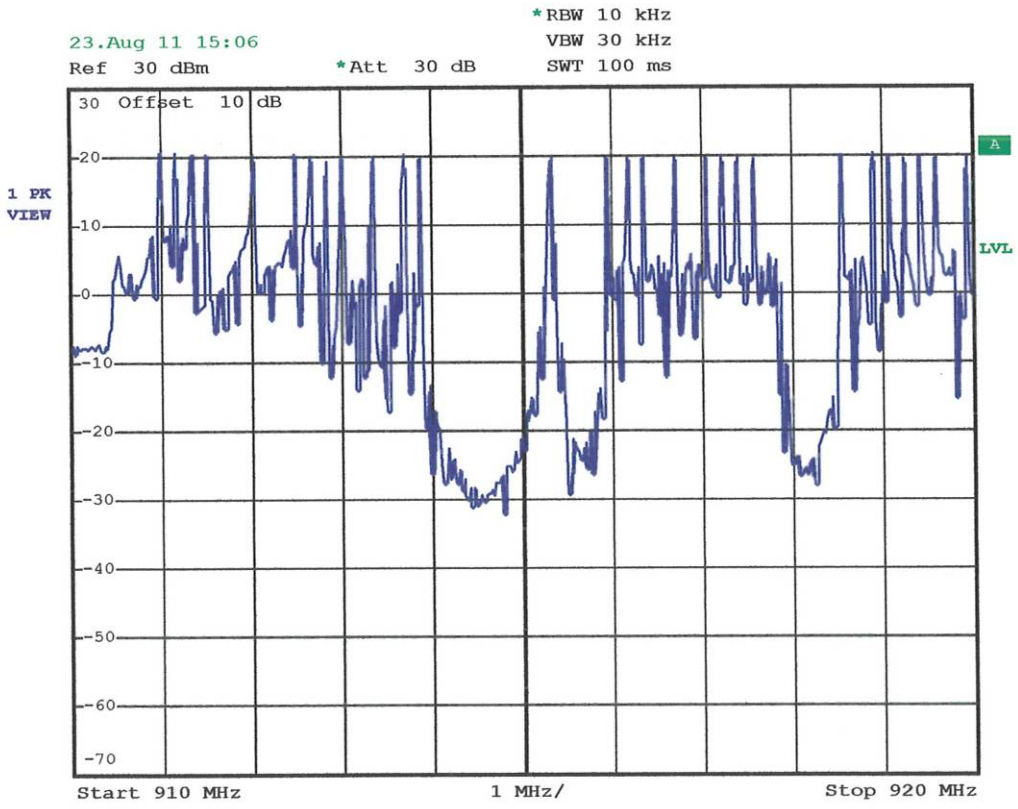


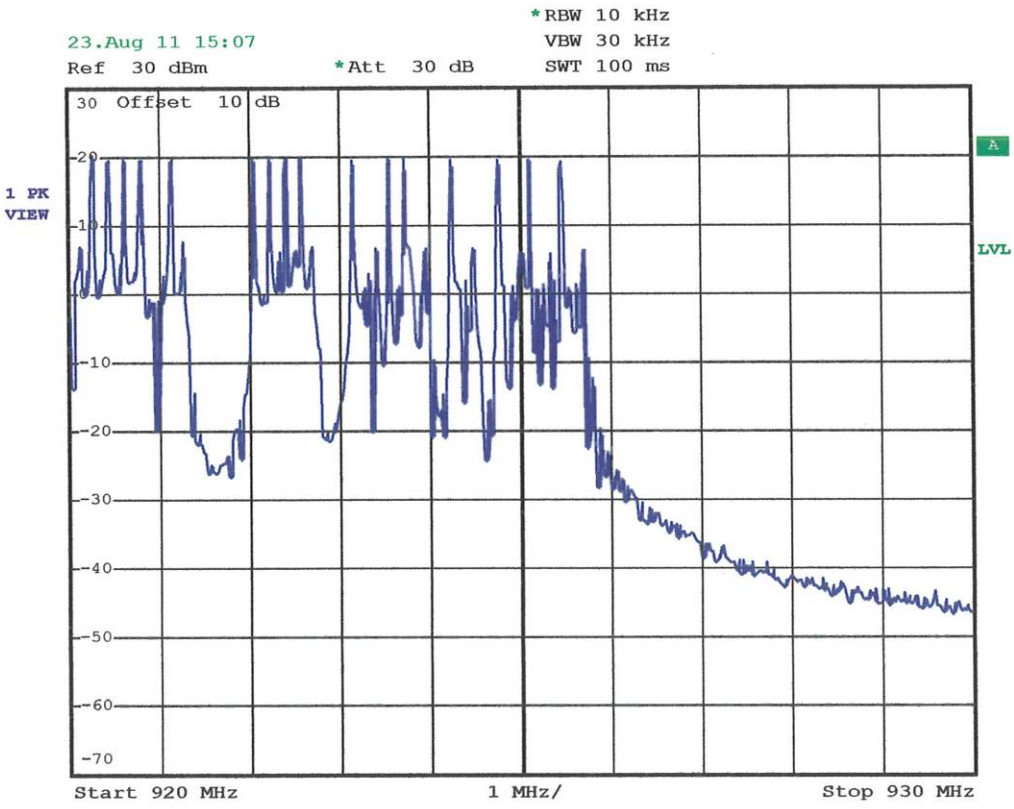
Date: 23.AUG.2011 15:28:33

ANNEX 3: NUMBER OF HOPPING FREQUENCIES



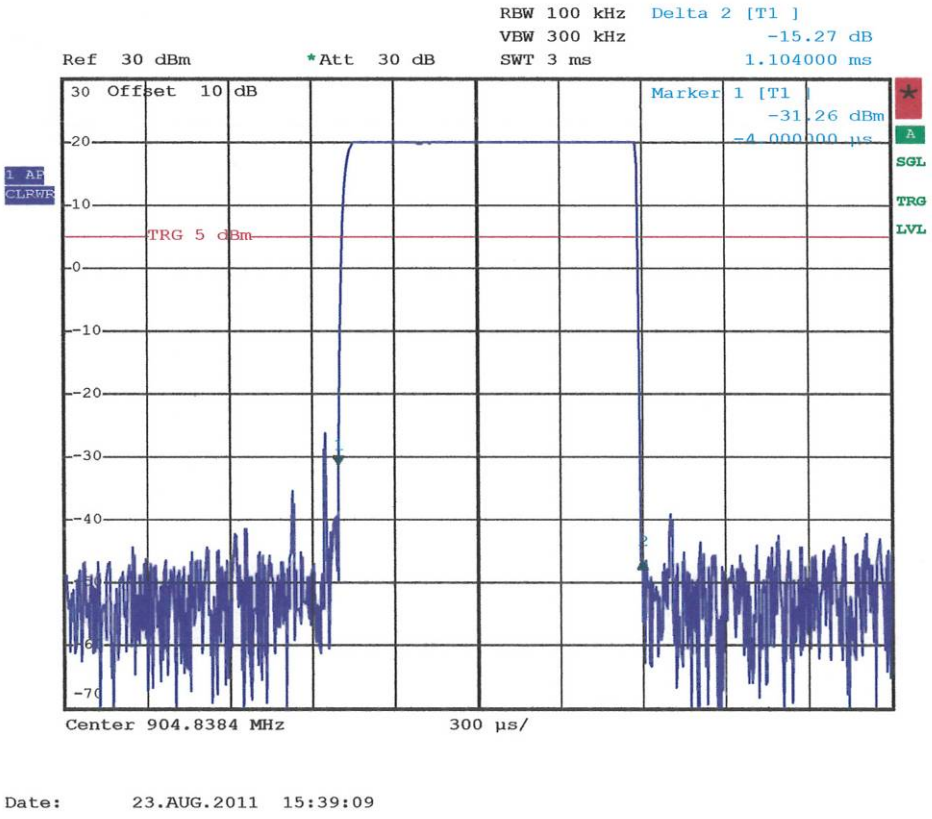


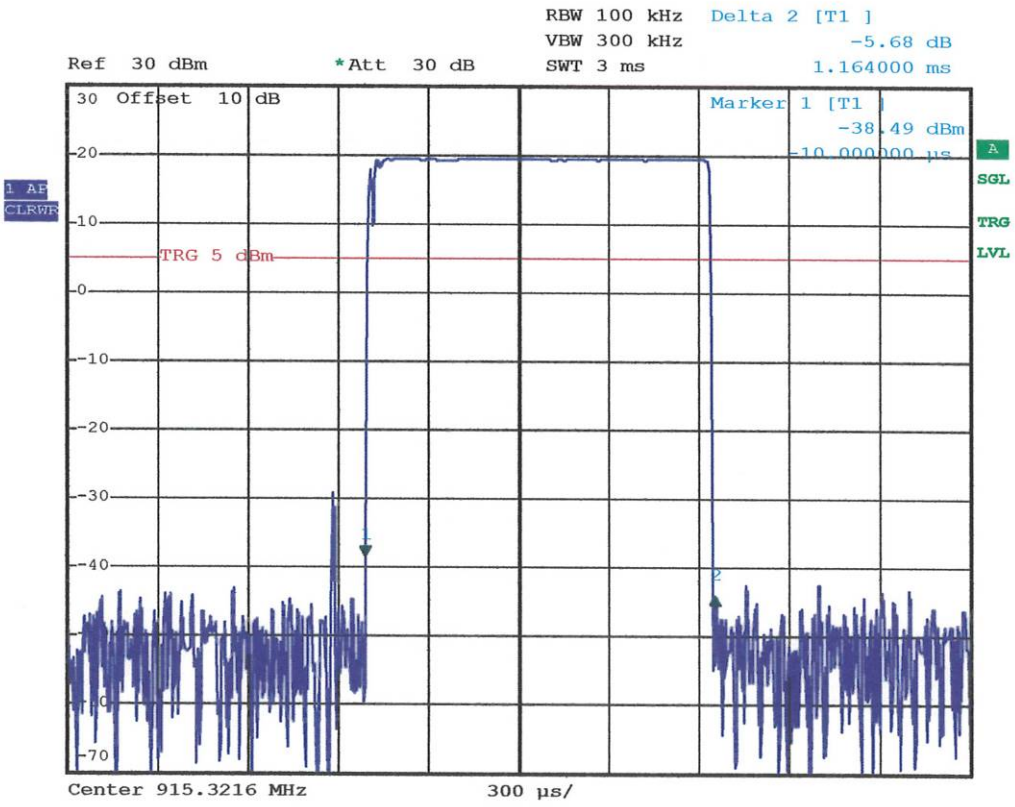
Date: 23.AUG.2011 15:06:09

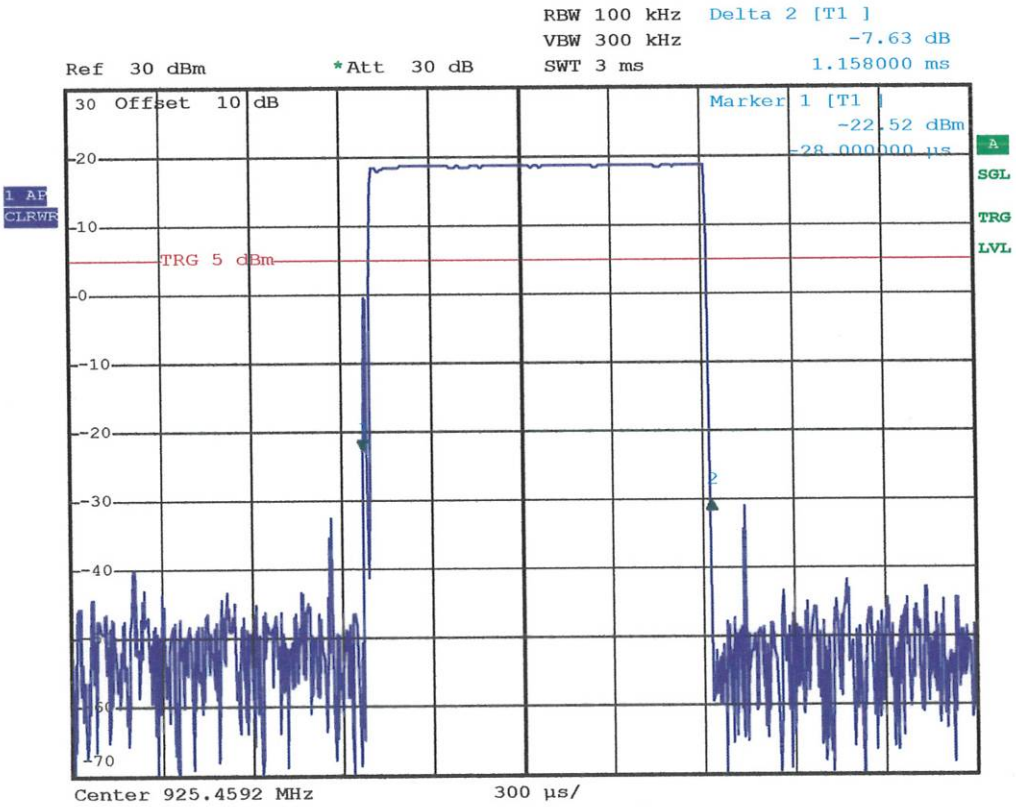


Date: 23.AUG.2011 15:07:26

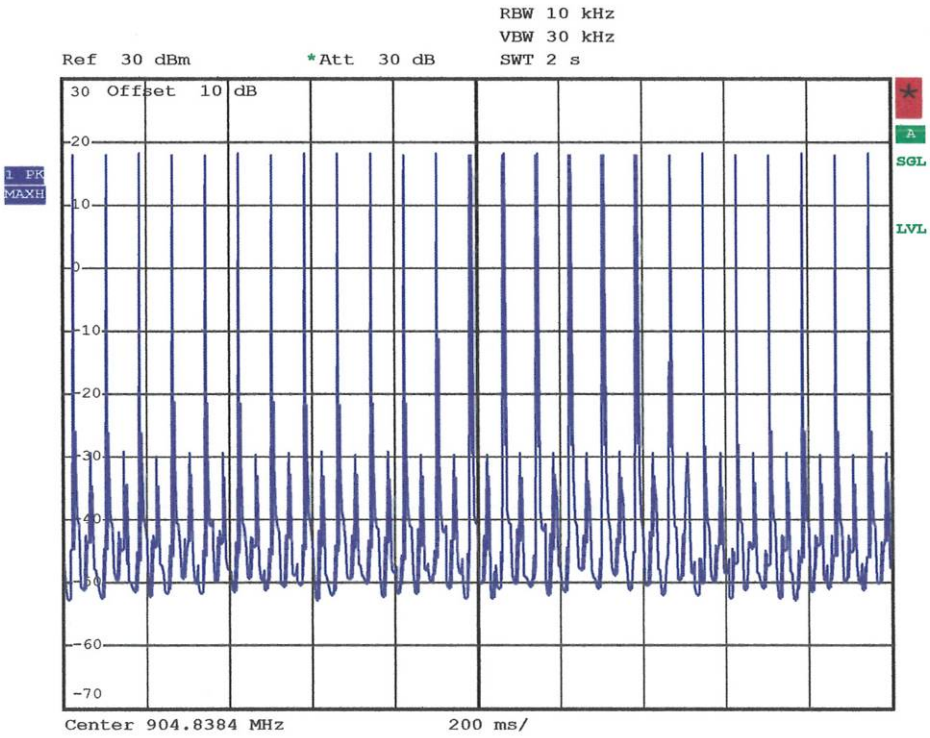
ANNEX 4: DWELL TIME



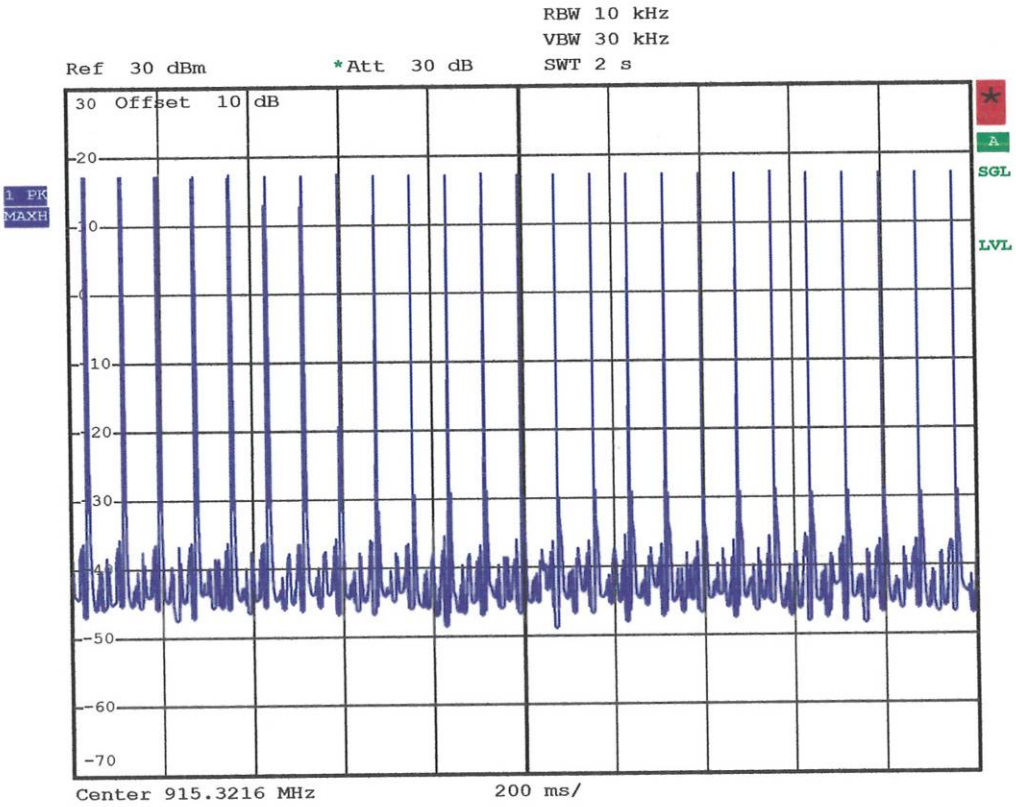

RBW 100 kHz
VBW 300 kHz
SWT 3 ms
Delta 2 [T1]
-5.68 dB
1.164000 ms
Ref 30 dBm
*Att 30 dB
30 Offset 10 dB
Marker 1 [T1]
-38.49 dBm
-10.000000 µs
1 AP
CLRWR
A
SGL
TRG
LVL
TRG 5 dBm
Center 915.3216 MHz
300 µs/
Date: 23.AUG.2011 15:40:06


RBW 100 kHz
VBW 300 kHz
SWT 3 ms
Delta 2 [T1]
-7.63 dB
1.158000 ms
Ref 30 dBm
*Att 30 dB
30 Offset 10 dB
Marker 1 [T1]
-22.52 dBm
-28.000000 µs
A
SGL
TRG
LVL
1 AP
CLRWR
TRG 5 dBm
Center 925.4592 MHz
300 µs/
Date: 23.AUG.2011 15:41:34

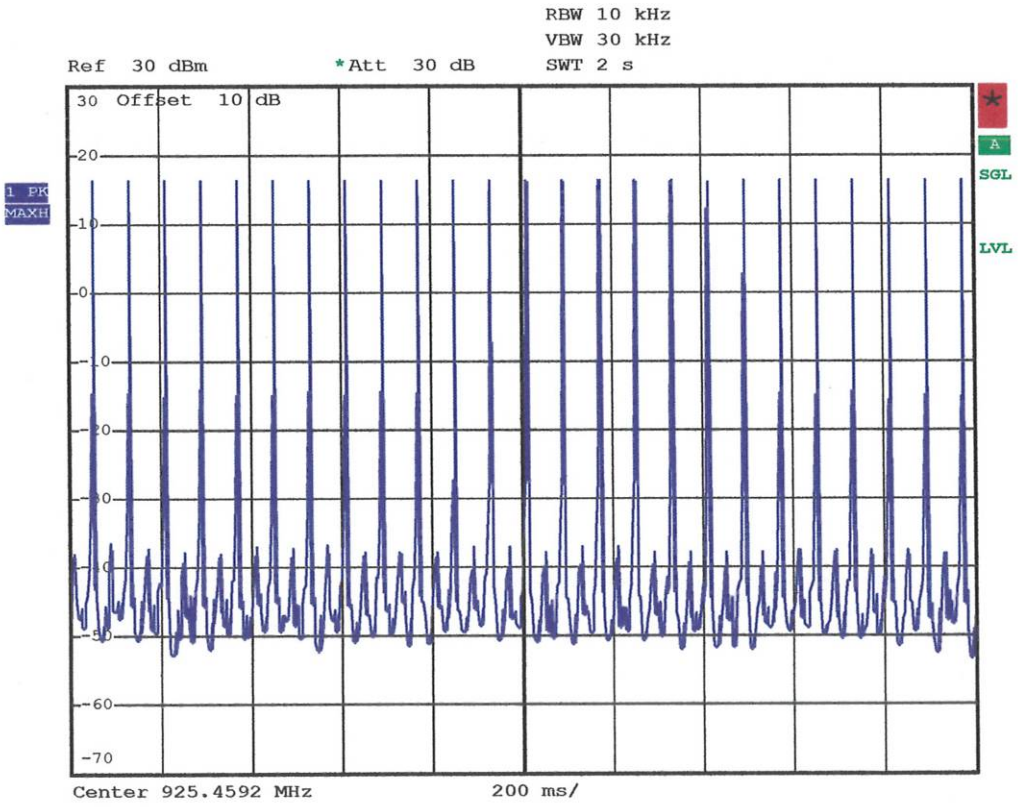
ANNEX 5: AVERAGE TIME OF OCCUPANCY



Date: 23.AUG.2011 16:16:20



Date: 23.AUG.2011 16:17:09

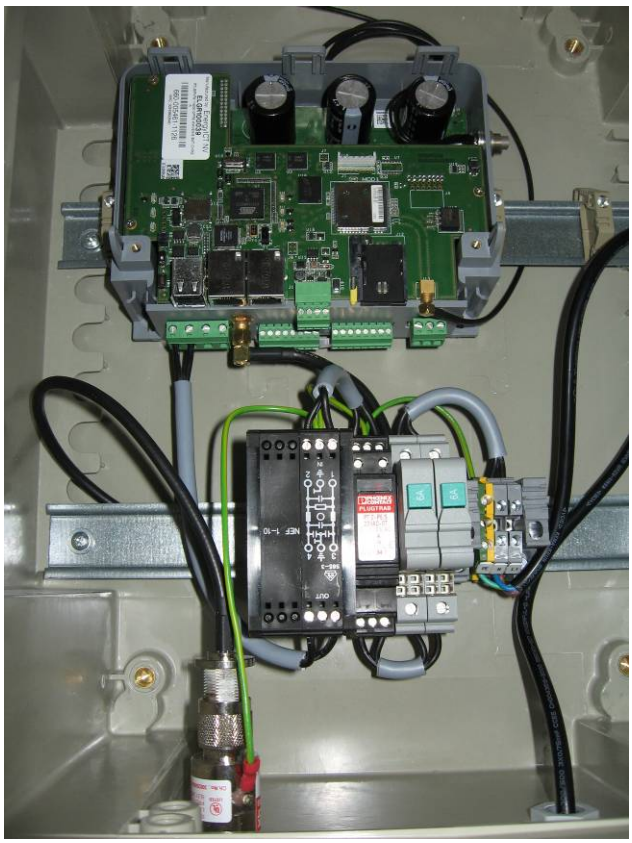


Date: 23.AUG.2011 16:18:17

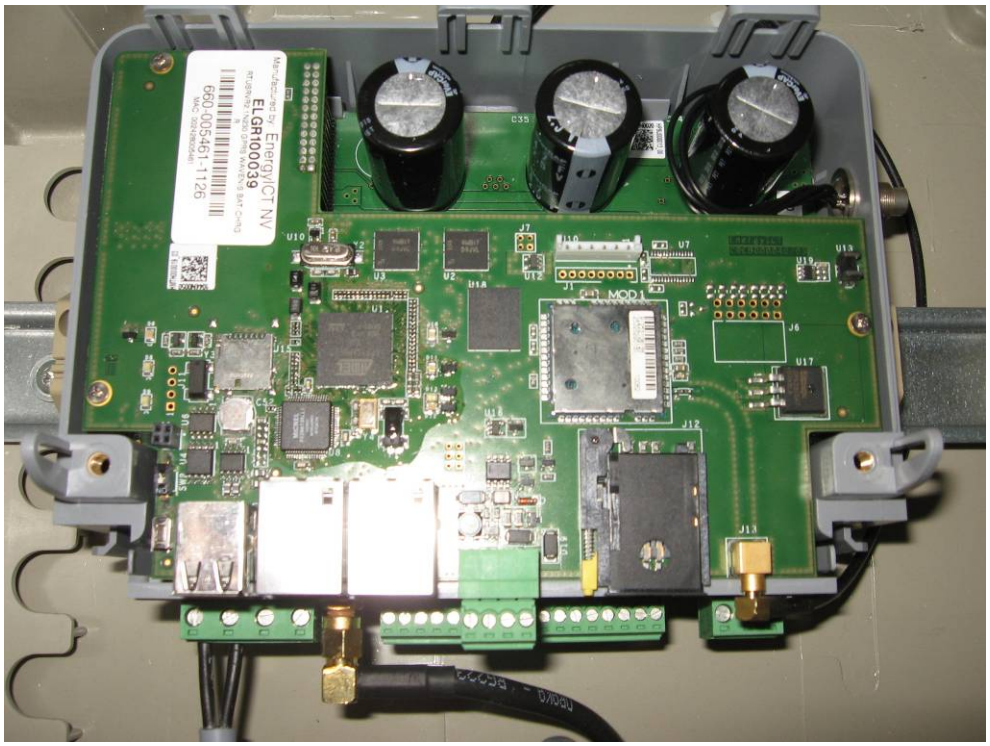
ANNEX 6: PICTURES OF THE EQUIPMENT UNDER TEST

GENERAL VIEW

INTERNAL VIEW



RADIO PART



ANTENNA

ANTENNA (DETAIL)

ANNEX 7: TEST CONFIGURATIONS

CONDUCTED MEASURE

RADIATED MEASURE

OPEN AREA TEST SITE