



## R051-24-09-105446-2/A Ed. 1

“This report cancels and replaces the test report N°R051-24-09-105446-2/A Edition 0”

<p><b>RADIO test report</b></p> <p><b>according to standard:</b> <b>FCC Part 15</b></p> <p><b>Equipment under test:</b> <b>WIRELESS BATTERYLESS TRANSMITTER</b> <b>(TRANSMITTER: ZBRT1 or ZBRTP)</b></p> <p><b>FCC ID:</b> <b>Y7HZBRT</b></p> <p><b>Company:</b> <b>SCHNEIDER ELECTRIC</b></p>
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**DISTRIBUTION: Mr BLANQUART**

**Company: SCHNEIDER ELECTRIC**

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**PRODUCT:** WIRELESS BATTERYLESS TRANSMITTER

**Reference / model:** ZBRT1 (transmitter) [or ZBRTP (transmitter of package)]

**Serial number:** not communicated

**MANUFACTURER:** SCHNEIDER ELECTRIC

**COMPANY SUBMITTING THE PRODUCT:**

**Company:** SCHNEIDER ELECTRIC

**Address:** ZI N°3  
BP 660  
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FRANCE

**Responsible:** Mr BLANQUART

**DATE(S) OF TEST:** 14 to 16 October 2010  
6 November 2010

**TESTING LOCATION:** EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE  
EMITECH ATLANTIQUE open area test site in LA POUENZE (49)  
FRANCE  
FCC Registration Number: 101696/FRN: 0006 6490 08

**TESTED BY:** M. DUMESNIL

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## **1. INTRODUCTION**

This document presents the result of RADIO test carried out on the following equipment:  
WIRELESS BATTERYLESS TRANSMITTER (TRANSMITTER: ZBRT1 or ZBRTP) in accordance with normative reference.

## **2. PRODUCT DESCRIPTION**

Number of samples used for the tests:

ZBRT1 (transmitter) [or ZBRTP (transmitter of package)]:

- sample N° 3

Class: B (residential environment)

Utilization: Wireless batteryless complete transmitter

Antenna type and gain: integrated PCB antenna, unknown gain

Operating frequency range: 2405 MHz

Number of channels: 1

Channel spacing: not concerned

Frequency generation: crystal

Power source: 3 Vd.c for the tests of the transmitter but it is self-powered when the user press the button.

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 (2009)	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.
KDB Publication 558074 (2005)	Measurement of Digital Transmission Systems Operating under Section 15.247
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. 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 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

**6.2 intentional radiator (subpart C)**

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				<i>Note 1</i>
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				<i>Note 2</i>
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	<i>(a) Alternative to general radiated emission limits</i>	X				
	<i>(b) Unwanted emissions outside of §15.247 frequency bands</i>	X				<i>Note 3</i>
	<i>(c) 20 dB bandwidth and band-edge compliance</i>	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	<i>(a) (1) Hopping systems</i>			X		
	<i>(a) (2) Digital modulation techniques</i>	X				<i>Note 4</i>
	<i>(b) Maximum peak output power</i>	X				<i>Note 5</i>
	<i>(c) Operation with directional antenna gains &gt; 6 dBi</i>			X		
	<i>(d) Intentional radiator</i>	X				<i>Note 6</i>
	<i>(e) Peak power spectral density</i>	X				
	<i>(f) Hybrid system</i>			X		
	<i>(g) Frequency hopping requirements</i>			X		
	<i>(h) Frequency hopping intelligence</i>			X		
	<i>(i) RF exposure compliance</i>	X				<i>Note 7</i>

NAp: Not Applicable

NAs: Not Asked

*Note 1: Integral PCB antenna.*

*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 minimum 6 dB bandwidth of the equipment is 1280 kHz (see annex 1).*

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

*Note 6: for average measurements a duty cycle correction factor is used ; see FCC part 15.35 (b).*

*Note 7: This equipment uses less than 0.5 W of output power with a high signal transmitting duty factor (section 3 from O et 65c).*

### **Conclusion:**

The sample of WIRELESS BATTERYLESS TRANSMITTER (TRANSMITTER: ZBRT1 or ZBRTP) 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

**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 HP 11966 C	Hewlett Packard	0728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Antenna RGA-60	Electrometrics	1204
Low-noise amplifier 1 to 18 GHz	ALC	2648
High pass filter HPM11630	Micro-tronics	6609
Open area test site	EMITECH	1274
Power source 6303DS	FI	4363
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Low-noise amplifier 2 to 18 GHz	Microwave DB	1922
High pass filter HP12/3200-5AA	Filtek	
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, 0.8 m from a ground plane. Zero degree azimuths correspond to the front of the equipment under test.

See photos in annex 3

**Frequency range:** From 9 kHz to 5<sup>th</sup> harmonic of the highest frequency used (2405 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 is blocked in standby mode.

**Results:**

Sample n°3

Ambient temperature (°C): 17.5

Relative humidity (%): 75

Power source: 3 Vd.c by an external 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. 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 FSP40	Rohde & Schwarz	4088
Antenna RGA-60	Electrometrics	1204
Power source E3610A	Hewlett Packard	4195
Multimeter 77-2	Fluke	0812
Meteo station AB888	Oregon Scientific	1539

**Test set up:**

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

**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): 23  
 Relative humidity (%): 43

Lower Band Edge: from 2310 MHz to 2390 MHz  
 Upper Band Edge: from 2483.5 MHz to 2500 MHz

Sample n°3:

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)
2404.2	84.96 (10 MHz)	Peak	2388.4	-35.68	49.28**	74	24.72
2405.6	80.82 (100 kHz)	Peak	2351.4	-48.79	32.03**	74	41.97
2405	84.96 (10 MHz)	Peak	2488.6	-42.18	42.78**	74	31.22
2405.4	80.82 (100 kHz)	Peak	2487.8	-50.87	29.98**	74	44.05

\* *Marker-Delta method*

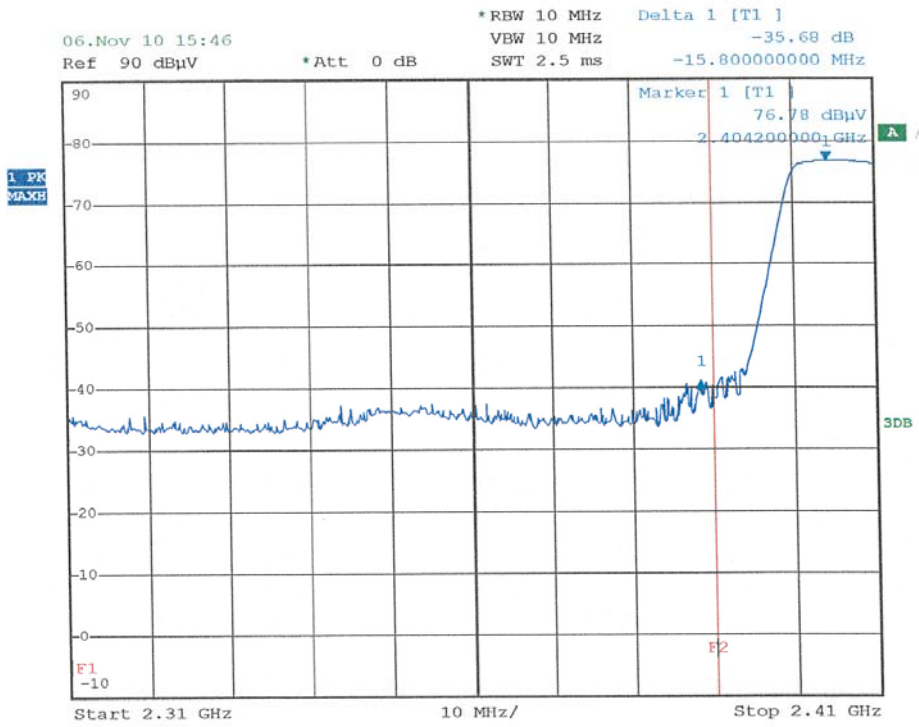
\*\* *The peak level is lower than the average limit (54 dBµV/m).*

See curve n°5 to curve n°8 on the following pages

**Test conclusion:**

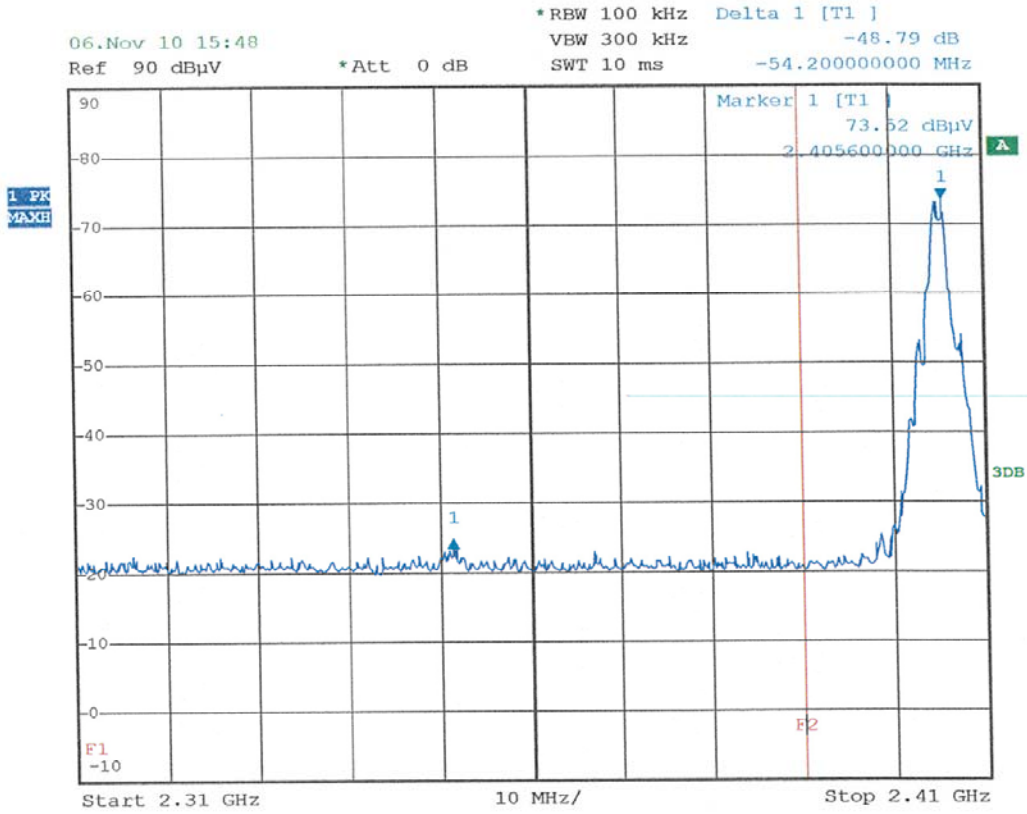
RESPECTED STANDARD

CURVE N°1.:



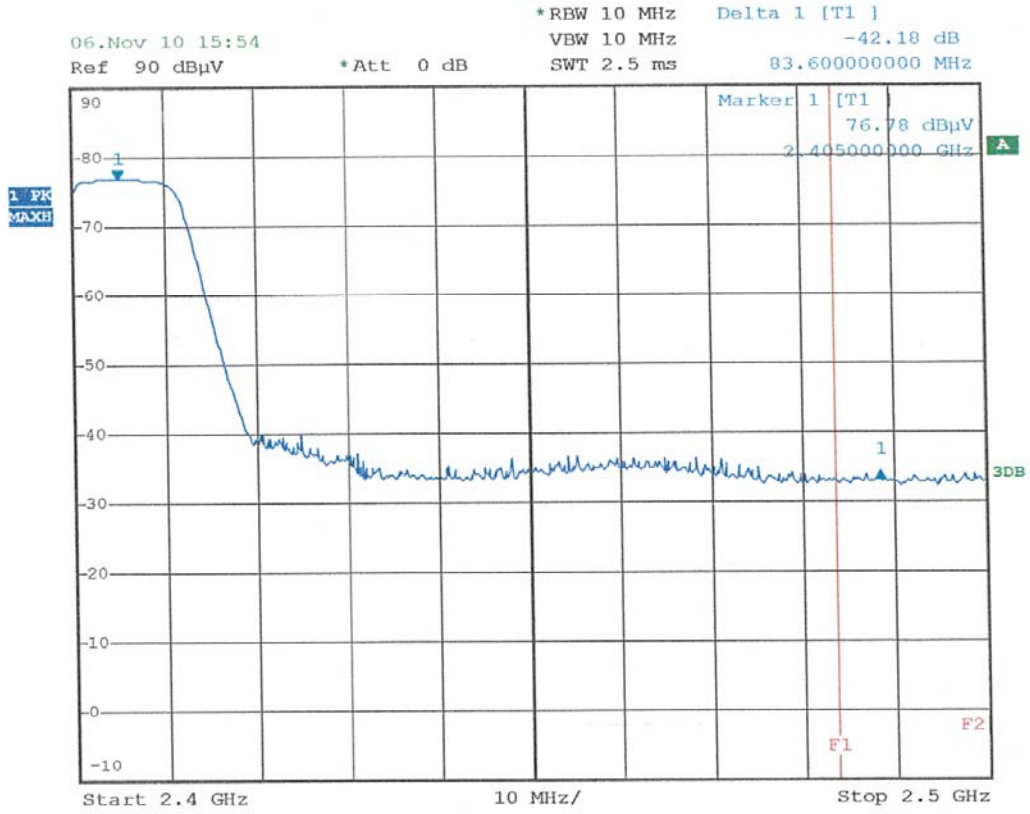
Date: 6.NOV.2010 15:46:07

CURVE N°2.:



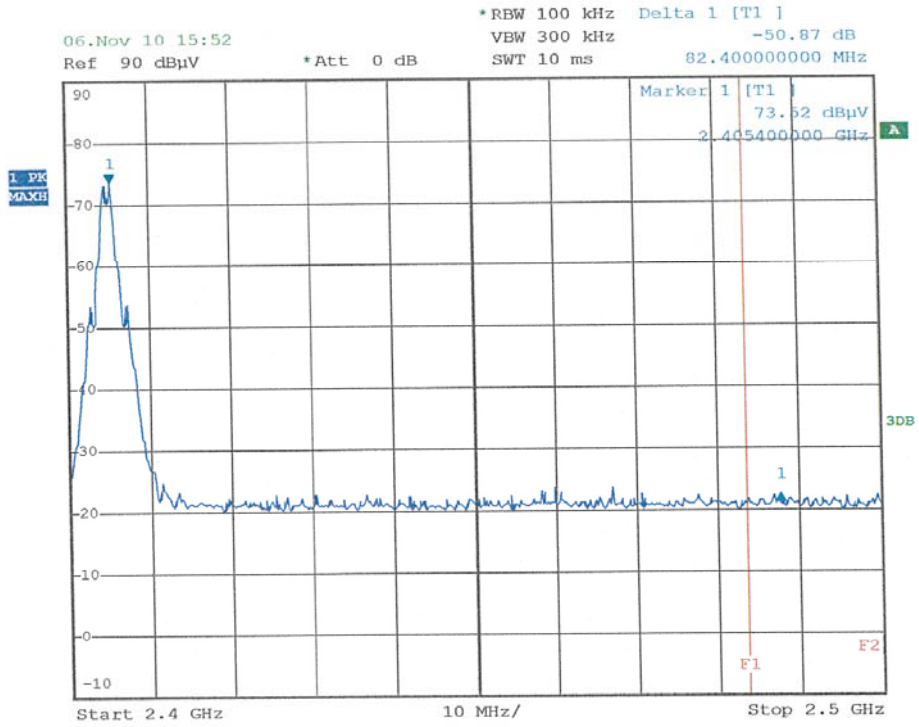
Date: 6.NOV.2010 15:48:11

CURVE N°3.:



Date: 6.NOV.2010 15:54:40

**CURVE N°4.:**



Date: 6.NOV.2010 15:52:04

## **9. MAXIMUM PEAK OUTPUT POWER**

**Standard:** FCC Part 15

**Test procedure:** paragraph 15.247 (b)

**Test equipments:**

<b>TYPE</b>	<b>BRAND</b>	<b>EMITECH NUMBER</b>
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Antenna RGA-60	Electrometrics	1204
Open area test site	EMITECH	1274
Power source E3610A	Hewlett Packard	4195
Multimeter 77-2	Fluke	0812
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, 0.8 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. 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.

A measurement of the electro-magnetic field is realized, with a resolution bandwidth and video bandwidth adjusted at 10 MHz.

**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): 15  
 Relative humidity (%): 75

Power source: 3 Vd.c by an external power source

Sample n° 3

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)
<b>Normal test conditions</b>	Nominal power source (V): 3	50.88	5.46	28.62	84.96	94 x 10 <sup>-6</sup>	125 x 10 <sup>-3</sup>

Polarization of test antenna: vertical (height: 144 cm)

Position of equipment: see photos in annex 3 (azimuth: 0 degrees)

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

**Test conclusion:**

RESPECTED STANDARD

**10. 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 HP 11966 C	Hewlett Packard	0728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Antenna RGA-60	Electrometrics	1204
Low-noise amplifier 2 to 18 GHz	Microwave DB	1922
High pass filter HP12/3200-5AA	Filtek	
Open area test site	EMITECH	1274
Power source E3610A	Hewlett Packard	4195
Multimeter 77-2	Fluke	0812
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, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

See photos in annex 3.

**Frequency range:** From 9 kHz to 10<sup>th</sup> harmonic of the highest fundamental frequency.

**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, 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): 17  
 Relative humidity (%): 68

Power source: 3 Vd.c by an external power source

Sample n°3:

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)
4810	P	212	121	1000	H	61.67	74*	12.33
4810	Av	212	121	1000	H	12.93 (1)	54*	41.07
7215	P	139	219	100	V	49.14	60.82	11.68

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

(1) All average value were taken using peak detector function with VBW = 10 Hz and the minimum duty cycle correction factor (see § 15.35, pulsed modulated device)

The applicant declare: 1) when the head of button is pushed the unit sends RF frames “bits”

2) the average number of frames is 3, for a duration of 0.6 ms each frame :  
 total duration = 3 x 0.6 ms = 1.8 ms

3) the transmitter is OFF for 498.2 ms.

So the minimum duty cycle correction factor is  $20 \text{ Log } \left[ \frac{3 \times 0.6 \times 10^{-3}}{100 \times 10^{-3}} \right] = -34.89 \text{ dB}$

*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 80.82 dBµV/m.

So the applicable limit is 60.82 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

**11. PEAK POWER DENSITY**

**Standard:** FCC Part 15

**Test procedure:** paragraph 15.247 (e)

**Test equipments:**

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Antenna RGA-60	Electrometrics	1204
Open area test site	EMITECH	1274
Power source E3610A	Hewlett Packard	4195
Multimeter 77-2	Fluke	0812
Meteo station meteostar	Bioblock Scientific	0943

**Test set up:**

We used the same method of the peak output power measurement, but the equipment under test power level is recorded with the spectrum analyzer.

Resolution bandwidth: 3 kHz  
Video bandwidth: 10 kHz

**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): 15  
Relative humidity (%): 75

Power source: 3 Vd.c by an external power source

Sample n° 3

	<b>Peak power density at frequency: 2405 MHz</b>
<b>Normal test conditions</b>	-22.92 dBm
<b>Limits</b>	+8 dBm

Polarization of test antenna: vertical (height: 144 cm)

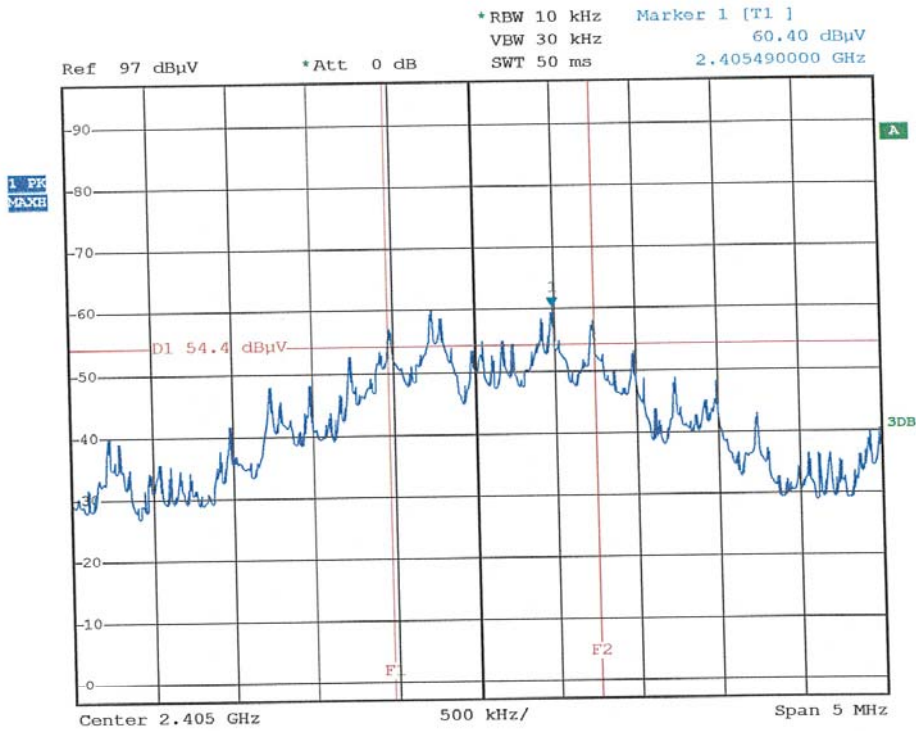
Polarization of equipment: see photos in annex 3 (azimuth: 0 degrees)

**Test conclusion:**

RESPECTED STANDARD

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

### ANNEX 1: 6 dB BANDWIDTH



$F_1 = 2406,471 \text{ MHz}$        $F_2 = 2405,951 \text{ MHz}$

Date: 16.OCT.2010 15:11:31

$\Delta = 1,28 \text{ MHz}$

## ANNEX 2: PHOTOS OF THE EQUIPMENT UNDER TEST

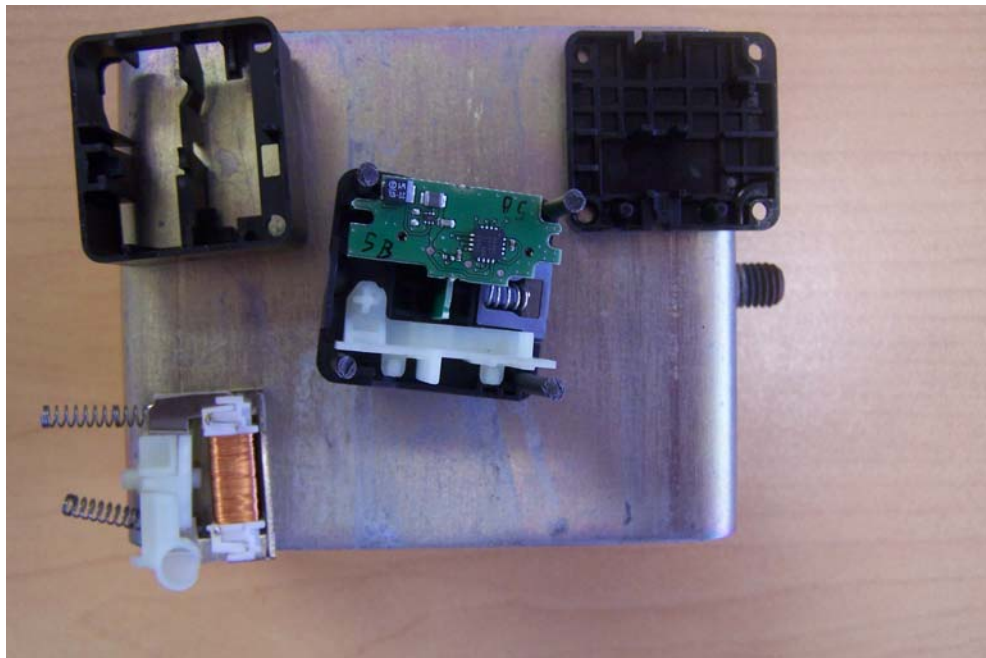
GENERAL VIEW



**GENERAL VIEW**

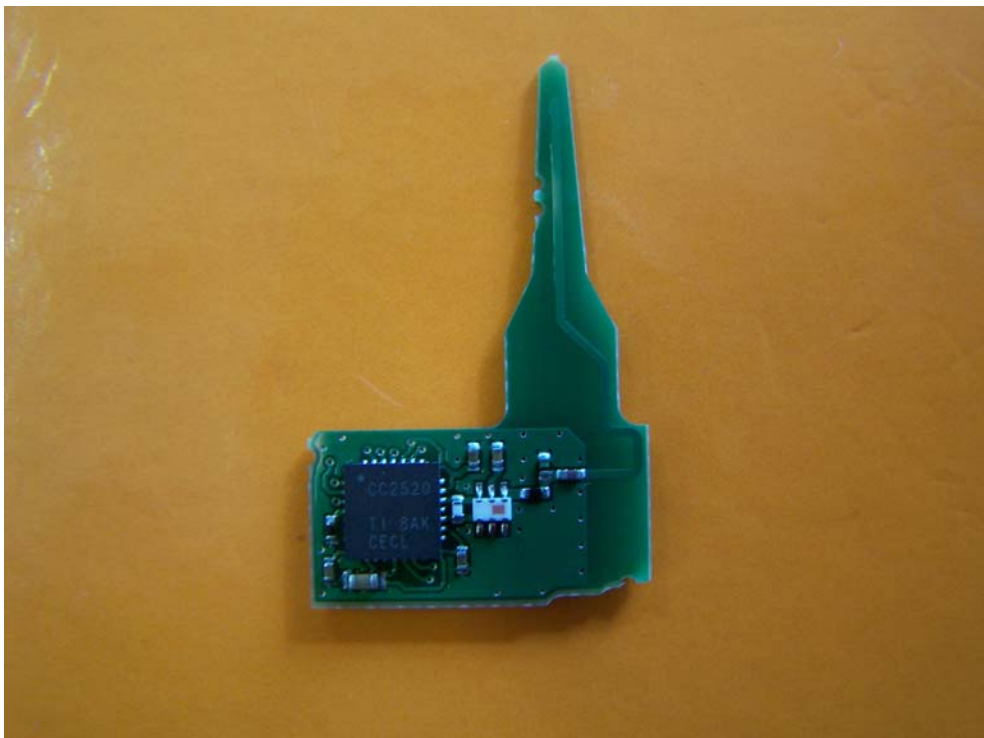
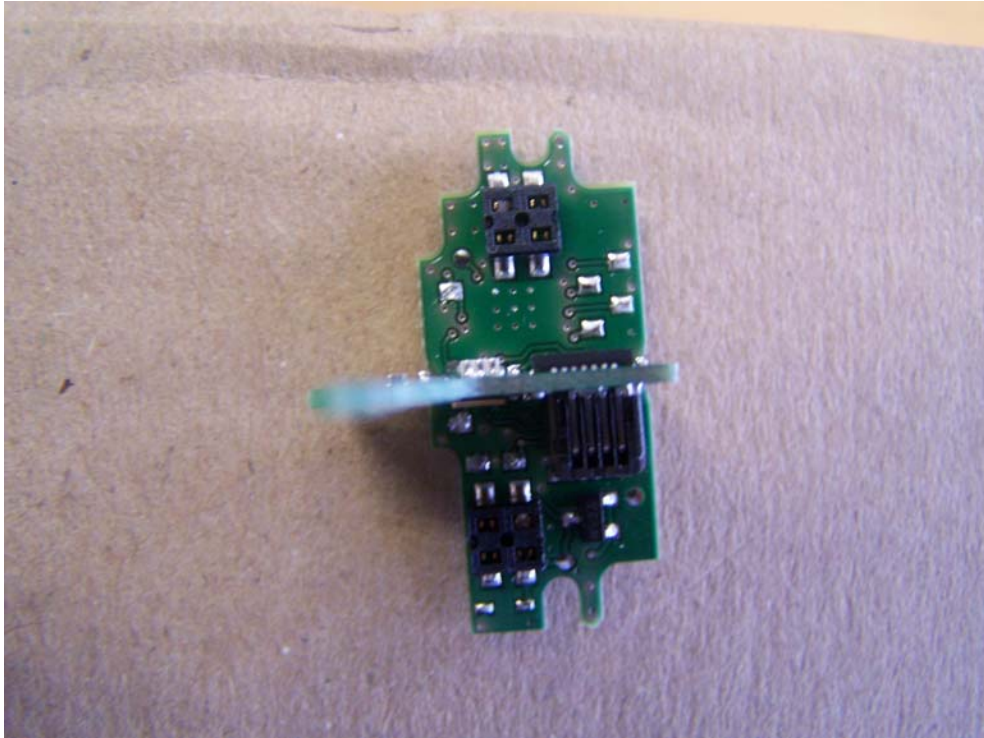


**INTERNAL VIEW**

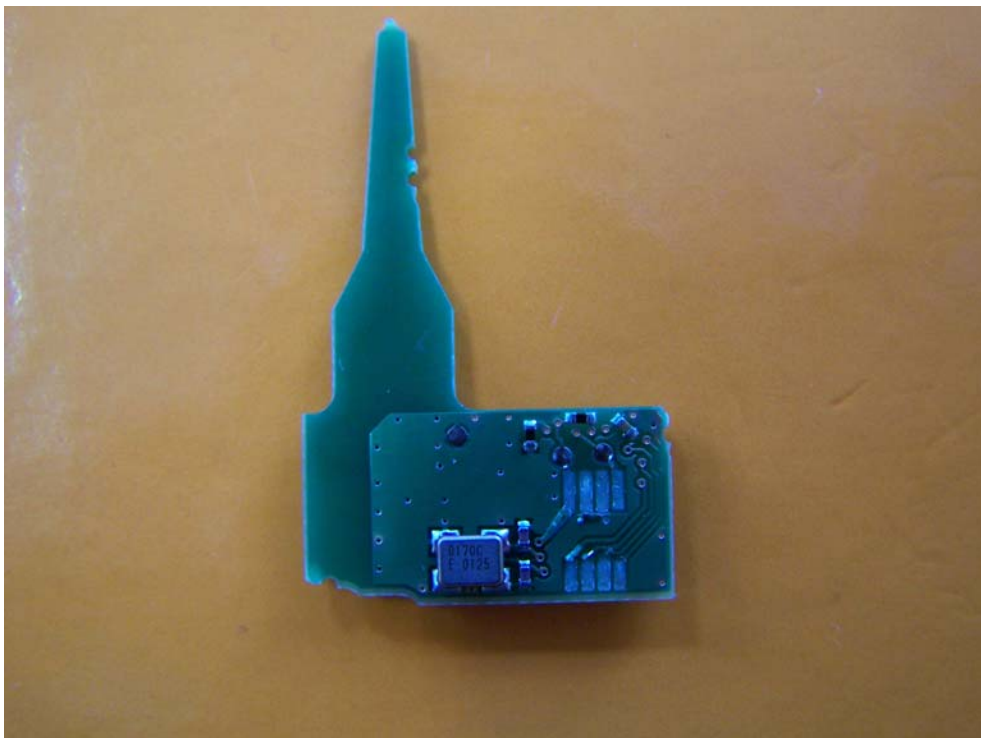
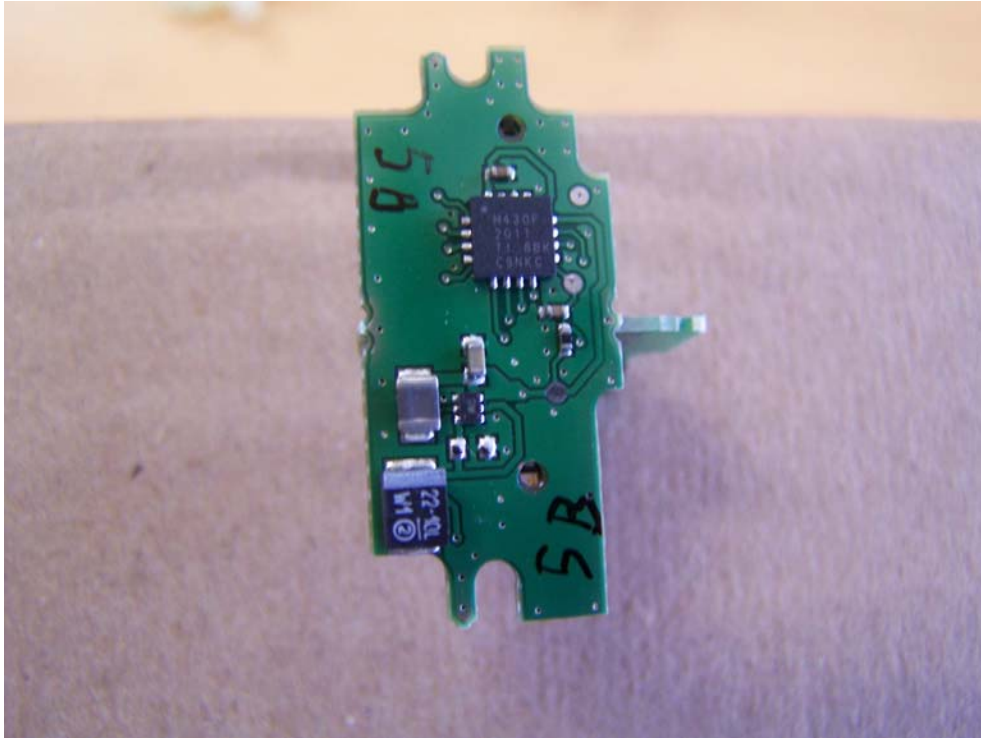




**PRINTED CIRCUIT BOARD: FACE 1**



**PRINTED CIRCUIT BOARD: FACE 2**



# ANNEX 3: TEST SET UP AND OPEN AREA TEST SITE

## RADIATED MEASUREMENTS







**OPEN AREA TEST SITE**

