RA-24-07101386-2/A Ed. 0

FCC CERTIFICATION
RADIO Measurement
Technical Report

standard to apply:
FCC Part 15.249

Equipment under test:
Electronic Voting System HM CAMPUS Transmitter

FCC ID:
V64E-HM-C-2400MHZ

Company:
NAVARIN S.A.

FOR THE ATTENTION OF: Mr GACEUS **Company: SOREC**

TRANSMIT TO: Mr GUETTA **Company: NAVARIN S.A.**

Number of pages: 13 including 1 annex

Ed.	Date	Modified pages	Written by Name / Visa	Technical Verification Quality Approval Name / Visa
0	8-Apr-08	Creation	L. BERTHAUD LB	P. BONNENFANT

PRODUCT: **Electronic Voting System**

Reference / model: HM CAMPUS Transmitter

Serial number: not communicated

MANUFACTURER: SOREC

COMPANY SUBMITTING THE PRODUCT:

Company: NAVARIN S.A.

Address: 36 bis rue Gay Lussac
94431 Chennevières Sur Marne
FRANCE

Responsible: Mr GUETTA

TECHNICAL SUPPORT:

Company: SOREC

Address: Z.A. le pâtureau de la grange
41200 Pruniers En Sologne
FRANCE

Responsible: Mr GACEUS

DATE(S) OF TEST: 14 November 2007

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

CONTENTS

TITLE **PAGE**

1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: Electronic Voting System HM CAMPUS - Transmitter in accordance with normative reference.

2. PRODUCT DESCRIPTION

Class: B (residential environment)

Utilization: Transmitter for Electronic Voting System

Antenna type: incorporated antenna

Operating frequency range: from 2401 MHz to 2482 MHz

Number of channels: 82

Channel spacing: 1 MHz

Frequency generation: O SAW Resonator O Crystal ⊙ Synthetiser

Modulation:

O Amplitude O Digital ⊙ Frequency O Phase

Power source: 3V Lithium battery (CR2032)

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.

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 209: radiated emission limits; general requirements
Paragraph 249: operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz and 24.0-24.25 GHz

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 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 15.249	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHZ, 5725-5875 MHZ AND 24.0-24.25 GHZ					
	(a) field strength fundamental and harmonics	X				
	(b) fixed point-to-point operation			X		
	(c) field strength distance	X				
	(d) radiated emissions outside specified frequency bands	X				
	(e) peak measurements	X				
	(f) requirement note of section 15.37 (d)			X		

NAp: Not Applicable NAs: Not Asked

Note 1: internal PCB antenna (see photos in annex).

Note 2: see FCC part 15.249 (d).

Conclusion:

The sample of Electronic Voting System HM CAMPUS - Transmitter 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. FIELD STRENGTH OF FUNDAMENTAL

Standard: FCC Part 15

Test procedure: paragraph 15.249

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna RGA-60	Electrometrics	1204
Antenna RGA-60	Electrometrics	1938
Open site	EMITECH	1274
Radiofrequency generator SME06	Rohde & Schwarz	1669
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Multimeter 77-2	Fluke	812

Test set up:

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

Detection mode: Peak
Resolution bandwidth: 1 MHz
Video bandwidth: 3 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 (%): 47

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of the test (V): 3.23
Voltage at the end of the test (V): 3.13

Sample n° 1 Channel 1 (2401 MHz)

Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro-magnetic field (dBµV/m)	P* (W)	Limit (dBµV/m)
59.78	4.62	28.90	93.3	0.389×10^{-3}	93.98

Polarization of test antenna: vertical (height: 119 cm)
Position of equipment: use position (azimuth: 194 degrees)

Sample n° 1 Channel 41 (2441 MHz)

Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro-magnetic field (dBµV/m)	P* (W)	Limit (dBµV/m)
59.16	4.65	29.02	92.83	0.349×10^{-3}	93.98

Polarization of test antenna: vertical (height: 116 cm)
Position of equipment: use position (azimuth: 190 degrees)

Sample n° 1 Channel 82 (2482 MHz)

Level (dBµV)	Cable loss (dB)	Antenna factor (dB)	Electro-magnetic field (dBµV/m)	P* (W)	Limit (dBµV/m)
59.46	4.69	29.14	93.29	0.388×10^{-3}	93.98

Polarization of test antenna: vertical (height: 120 cm)
Position of equipment: use position (azimuth: 191 degrees)

* $P = (E \times d)^2 / (30 \times Gp)$ with d = 3 m and Gp = 1.65 (2.17 dBi)

Test conclusion:

RESPECTED STANDARD

8. RADIATED EMISSION OF TRANSMITTER

Standard: FCC Part 15

Test procedure: paragraph 15.205
paragraph 15.209
paragraph 15.249

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
Multimeter 77-2	Fluke	812

Test set up:

The system is tested in an open area test site (OATS) and 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 ($F_{carrier} \leq 10$ GHz)

Bandwidth: 120 kHz (F < 1 GHz) or 100 kHz, following 15.205 or 15.249
1 MHz (F > 1 GHz) or 100 kHz, following 15.205 or 15.249

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): 19.5
Relative humidity (%): 47

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of the test (V): 3.23
Voltage at the end of the test (V): 3.13

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

Channel 1 (2401 MHz)

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)
4801.94	Avg	232	28	1000	V	35.27	53.98	18.71
4801.94	Peak	232	28	1000	V	60.18	73.98	13.8

Channel 41 (2441 MHz)

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)
4882.19	Avg	244	31	1000	V	35.48	53.98	18.5
4882.19	Peak	244	31	1000	V	58.33	73.98	15.65

Channel 82 (2482 MHz)

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)
4963.64	Avg	242	194	1000	H	35.04	53.98	18.94
4963.64	Peak	242	194	1000	H	56.95	73.98	17.03

Any spurious which has more than 20 dB of margin compared to the limit is not necessarily reported.

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 1 annex to be forwarded □□□

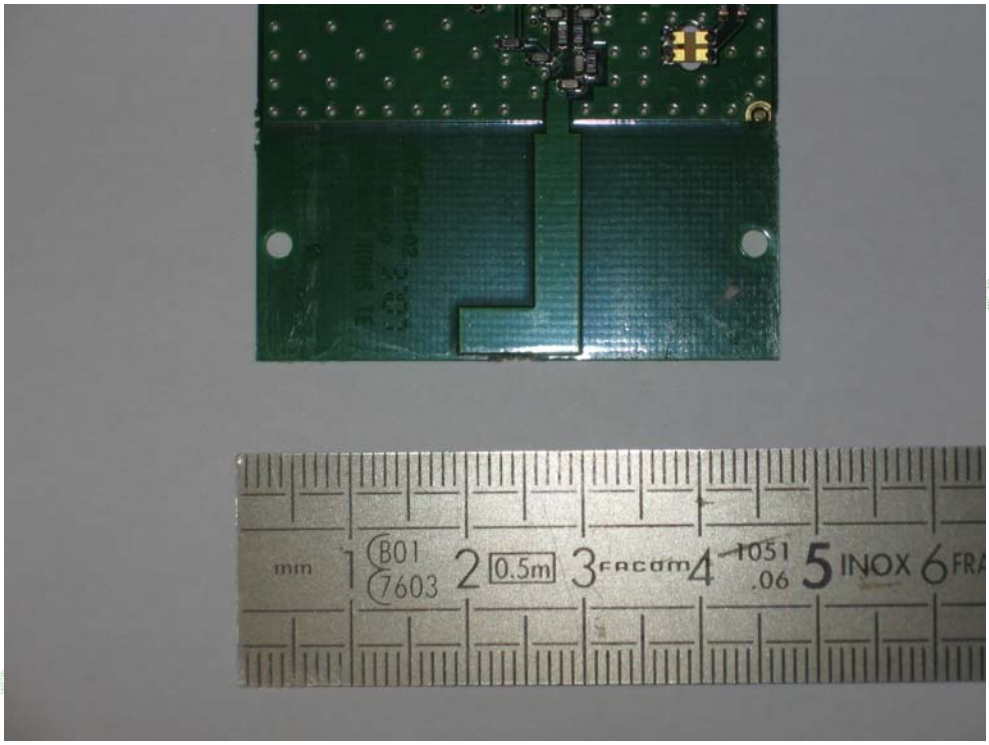
ANNEX: PHOTOS OF THE EQUIPMENT UNDER TEST

GENERAL VIEW

Printed circuit board: face 1

Printed circuit board: face 2

Antenna



Test set up radiated measurement