

R041-10-100039-1A - DM / CD

RADIO TEST REPORT

According to the standard(s):

FCC part 15 Subpart C 15.225 (07/2008)

Equipment under test:

FAREBOX FBE420


Company:

AFFILIATED COMPUTER SERVICES SOLUTIONS FRANCE SAS

Diffusion: Mr VILLERET

(Company: AFFILIATED COMPUTER
SERVICES SOLUTIONS FRANCE SAS)

Number of pages: 24 including 1 annex

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NAME OF THE EQUIPMENT UNDER TEST (E.U.T.) : FAREBOX FBE420

Serial number : None

Part number : 87729211V01

Software Version : None

MANUFACTURER'S NAME : AFFILIATED COMPUTER SERVICES
SOLUTIONS FRANCE SAS

APPLICANT'S ADRESS:

Company : AFFILIATED COMPUTER SERVICES
SOLUTIONS FRANCE SAS

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FRANCE

Person(s) present during the tests : Mr REIG

Responsible : Mr VILLERET

DATE(S) OF TESTS : February 9th and 10th of 2010

TESTS LOCATION(S) : Emitech Grand Sud Laboratory in
Vendargues (34)
Open area test site in Salinelles (30)
FCC Registration number: 8127-19

TESTS SUPERVISOR(S) : None

TESTS OPERATOR(S) : Regis GONZALEZ

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1. INTRODUCTION

This document submits the results of Electromagnetic Compatibility tests performed on the equipment FAREBOX FBE420 (denominated hereafter E.U.T.: equipment under test) according to document(s) listed below.

2. REFERENCE DOCUMENT(S)

FCC Part 15 (July 2008)

Code of Federal Regulations
Title 47 – Telecommunications
Chapter 1 – Federal Communications Commission
Part 15 – Radio frequency devices
Subpart C – Intentional Radiators

ANSI C 63.4 (2003)

American National Standard for Methods of measurement of
Radio-Noise from low-voltage
Electrical and Electronic Equipment in the Range of 9 kHz to
40 GHz

3. EQUIPMENT UNDER TEST CONFIGURATION

Product description:

The FBE420 is radio equipment with a contactless card interface (13.56MHz with an internal antenna). The maximum frequency of the CPU is 133MHz.

The FAREBOX is a piece of equipment that is installed on buses and is to be used by passengers for cash transactions to purchase tickets, for issuing of magnetic tickets and for the validation of magnetic tickets or contactless smart cards.

FCC ID: U36-FBE420

ITU emission code: /

Utilization: RFID TAG reader

Antenna type: Incorporated antenna

Antenna gain: Unknown

Operating frequency range: 13.56 MHz

Number of channels: 1

Channel spacing: /

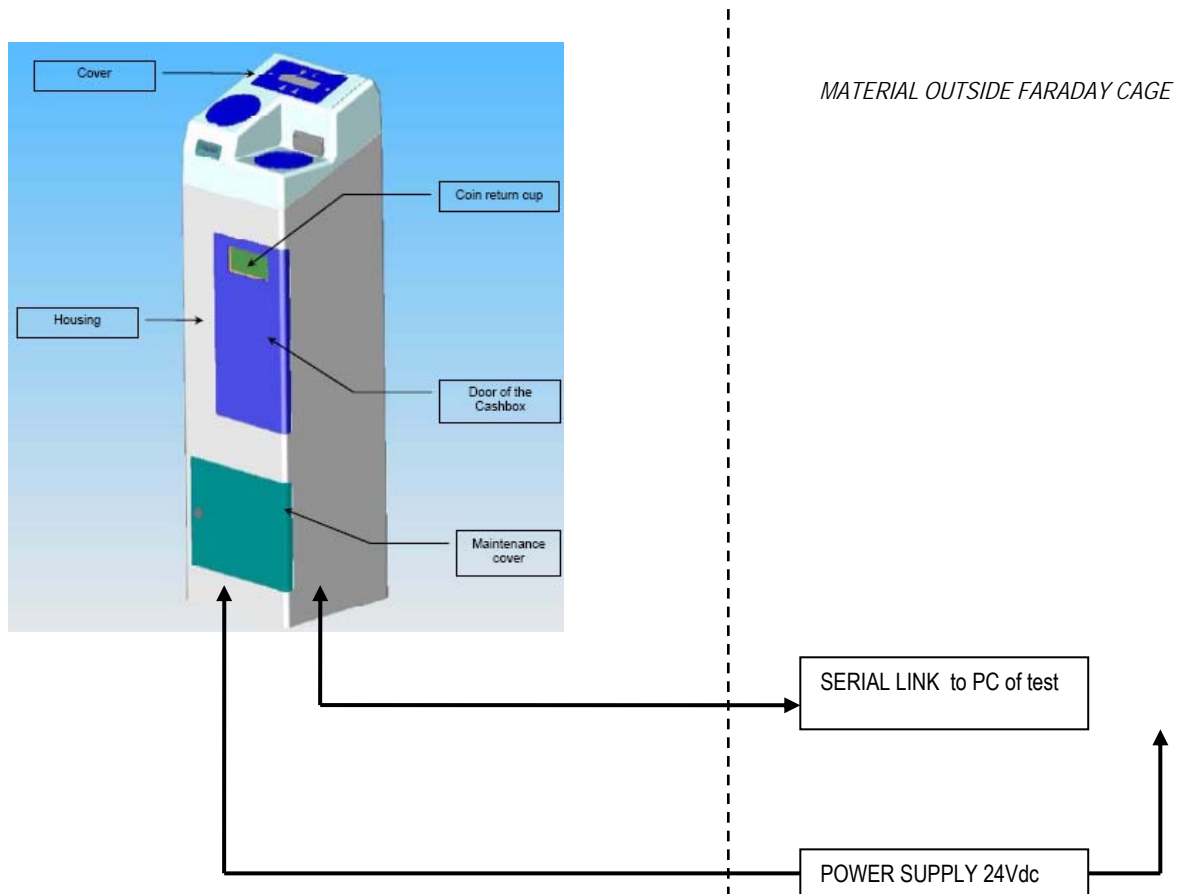
Modulation: /

Power source: 24 Vdc (vehicular use)

Power level and frequency range are not user adjustable

4. EQUIPMENT UNDER TEST CONFIGURATION SCHEME

The FBE420 is a piece of equipment that is installed on buses and is to be used by passengers for cash transactions to purchase tickets, for issuing of magnetic tickets and for the validation of magnetic tickets or Contactless smart cards.



5. SUMMARY OF TEST RESULTS

Tests designation	Results satisfying?	Comments
Antenna requirement - section 15.203	YES	Integrated antenna
Restricted band of operation - section 15.205	NA	See 15.205 (d) (4)
Conducted emissions - section 15.207	YES	
Radiated emissions - section 15.209 (below 30MHz)	YES	
Radiated emissions - section 15.209 (above 30MHz)	YES	
Field strength - section 15.225	YES	
Frequency tolerance - section 15.225	YES	

N.P.: Not Performed.

N.A.: Not Applicable.

- In emission:

Sample subject to the test complies with prescriptions of the standard(s) FCC part 15 Subpart C 15.225 (07/2008) according to limits specified in this test report.

6. CONDUCTED EMISSIONS – SECTION 15.207

Standard: FCC part 15 Subpart C 15.225 (07/2008)

Test method: ANSI C63.4:2003

Test configuration:

Tested cable(s)	Measure with	E.U.T. height
24Vdc power supply	L.I.S.N.	3 cm

Frequency band	Tested cable(s)	Resolution bandwidth	Video bandwidth	Detection mode
150kHz-30MHz	24Vdc power supply	10KHz	30kHz	Peak/Average

Test method deviation: No

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Software	Nexio	BAT EMC	0000
Shielded enclosure	RAY PROOF	C.GS1	1423
Cable		N-1m	2704
Cable		N-5m	2899
Limiter	Hewlett Packard	11947A	0239
Receiver	Agilent	E4440A	5824
Receiver	Rohde & Schwarz	ESHS10	3371
LISN	PMM	L3-25	0821

BAT-EMC software version: V3.5.0.2

Results: See Graph(s) hereafter. Limits on the graphs are average and quasi-peak limits (upper limit).

Conducted voltage emission (measurement)

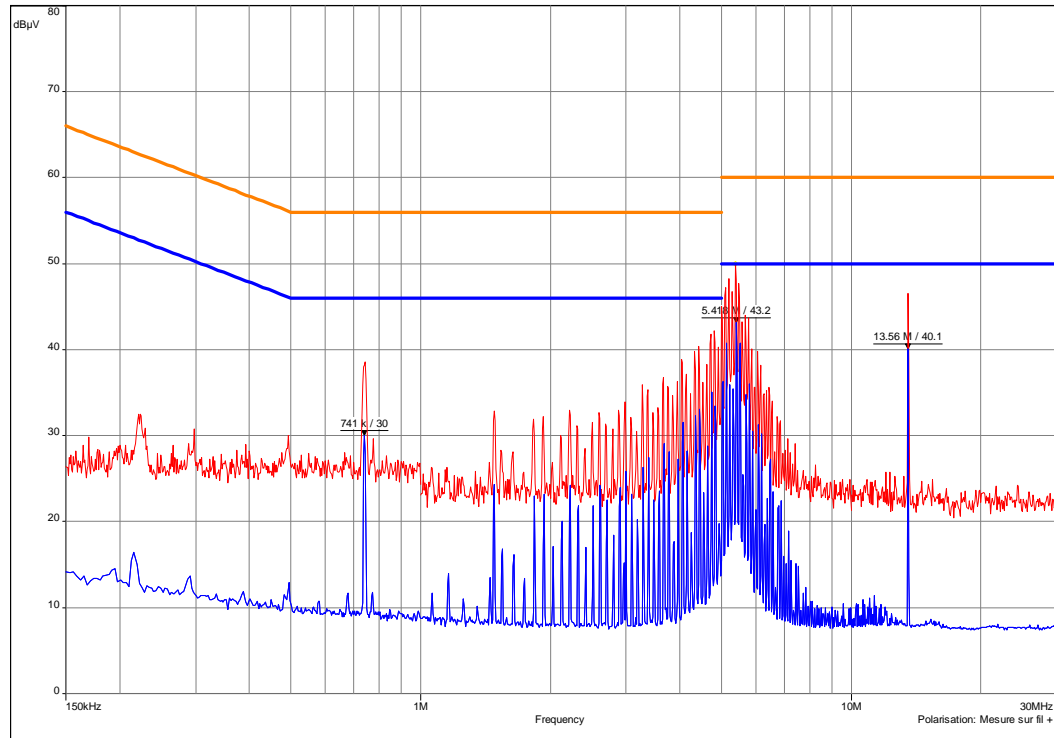
24Vdc power supply

Classe: B of the standard

Detection: Peak and average

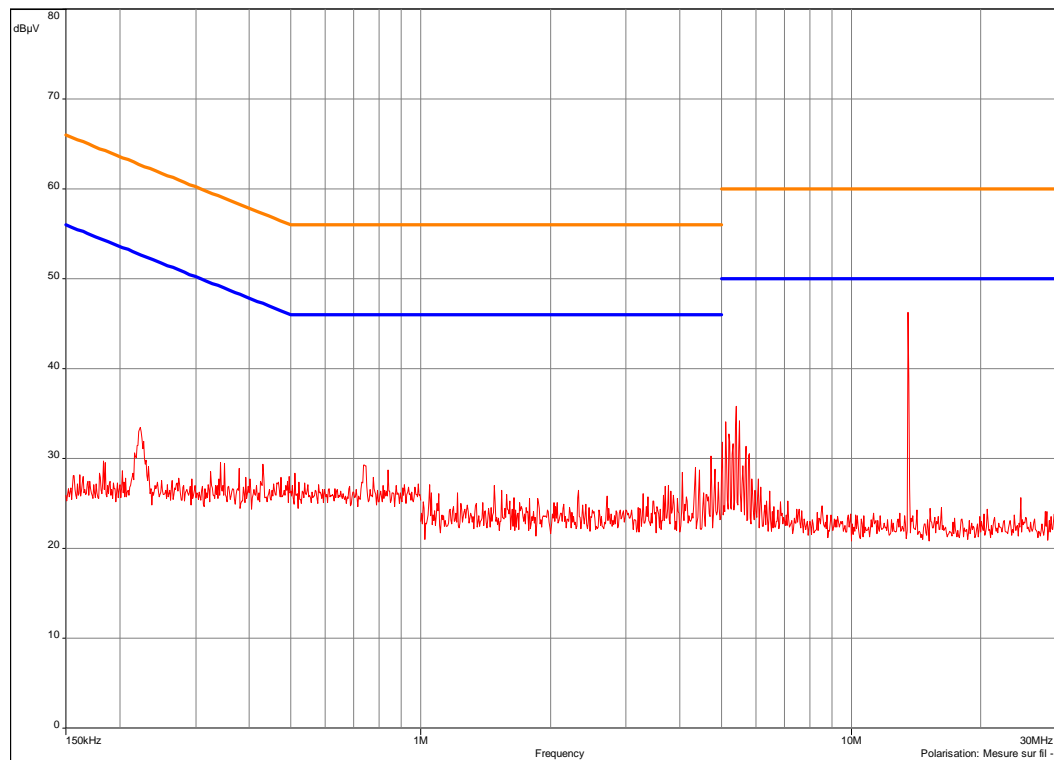
09/02/2010

C.E.M. (civil)/EN 55022 - Class B - Moyenne/
 C.E.M. (civil)/EN 55022 - Class B - QCrête/
 Mes.Peak (Mesure sur fil +)
 Mes.Avg (Mesure sur fil +)
 Peak/LimAvg (Mesure sur fil +)



24Vdc power supply - 02/09/2010 14:03 - 932

C.E.M. (civil)/EN 55022 - Class B - Moyenne/
 C.E.M. (civil)/EN 55022 - Class B - QCrête/
 Mes.Peak (Mesure sur fil -)



24Vdc power supply - 02/09/2010 14:03 - 932

7. RADIATED EMISSIONS – SECTION 15.209

Temperature (°C): 21.5

Humidity (%HR): 33

Pressure (hPa): 989

a) Radiated emissions pre-measurement (below 30MHz)

Standard: FCC part 15 Subpart C 15.225 (07/2008)

Test method: ANSI C63.4:2003

Test configuration:

Frequency band	Tested side	Resolution bandwidth	Video bandwidth	Detection mode	E.U.T. height
9kHz-150kHz	Front side / antenna 0°	200Hz	1kHz	Peak	3cm
9kHz-150kHz	Front side / antenna 45°	200Hz	1kHz	Peak	3cm
9kHz-150kHz	Front side / antenna 90°	200Hz	1kHz	Peak	3cm
150kHz-30MHz	Front side / antenna 0°	10kHz	30kHz	Peak	3cm
150kHz-30MHz	Front side / antenna 45°	10kHz	30kHz	Peak	3cm
150kHz-30MHz	Front side / antenna 90°	10kHz	30kHz	Peak	3cm

Measure is done with an antenna position of 0°, 90° and 45°.

Test method deviation:

Measurements are made in peak detection instead of average mode in frequency band 9kHz-500kHz

- Measurements are given in dBμA/m instead of μV/m
- Measuring distance is 3 meters instead of 30 and 300 meters

Radiated emissions limits in this frequency band are specified at 30 or 300 meters. Measurement distance used during the test, subject of this report, is 3 meters. Then published limits come from a theoretical conversion using an extrapolation factor of 40dB / decade.

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Rohde & Schwarz	HFH2-Z2	5825
Cable	C&C	N-1.5m	5017
Cable	C&C	N-8m	5014
Receiver	Agilent	E4440A	5824
Software	Nexio	BAT EMC	0000

BAT-EMC software version: V3.5.0.2

Results: See Graph(s) hereafter (pre-measurement).

b) Radiated emissions pre-measurement (above 30MHz)

Standard: FCC part 15 Subpart C 15.225 (07/2008)

Test method: ANSI C63.4:2003

Test configuration:

Frequency band	Tested side	Resolution bandwidth	Video bandwidth	Detection mode	E.U.T. height
30MHz-1GHz	Front side (pre-measurement in semi anechoic chamber)	100kHz	300kHz	Peak	3cm
1GHz-1.5GHz	Front side (pre-measurement in semi anechoic chamber)	1MHz	3MHz	Peak	3cm

Measurement has been performed to 10th harmonic of higher internal frequency of the system.

Test method deviation: No

Measuring distance: 3 meters

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	ETS LINDGREN	3117	5456
Antenna	Electro-Metrics	BIA-30HF	0824
Antenna	Electro-Metrics	LPA-30	0855
Cable		N-1m	2703
Cable		N-1m	2704
Cable		N-5m	2899
Preamplifier	Microwave	C005180F-4B1	2165
Preamplifier	Mini-circuit	ZFL-1000LN	1119
Receiver	Agilent	E4440A	5824
Shielded enclosure	RAY PROOF	C.GS1	1423
Software	Nexio	BAT EMC	0000

BAT-EMC software version: V3.5.0.2

Results: See Graph(s) (indoor pre-measurement)

Radiated magnetic field emission (Pre-measurement)

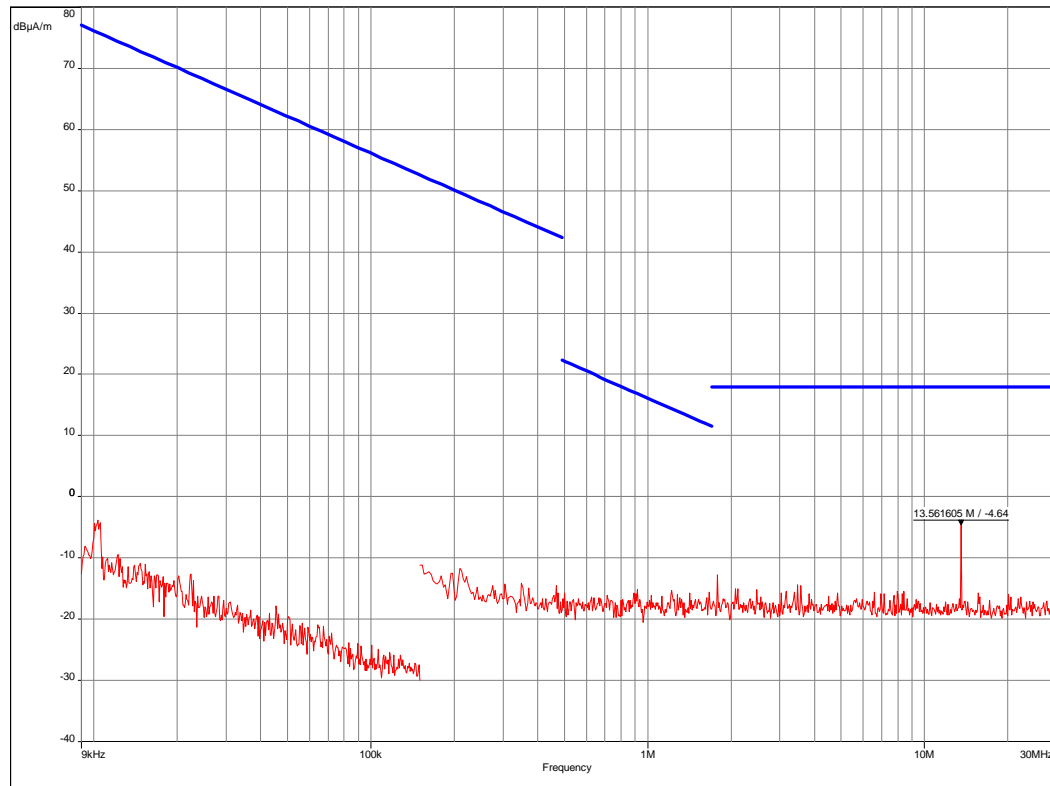
Front side / antenna 0°

Classe:

Detection: Peak

09/02/2010

RADIO/FCC part15.209 (40dB/dec) - Class:ss - Crête/3.0m/
Mes.Peak



Front side / antenna 0° - 02/09/2010 10:23 - 911

Limit indicated on this plot is calculated with 40 dB/decade extrapolation factor and 51.5 dB conversion factor.

Radiated magnetic field emission (Pre-measurement)

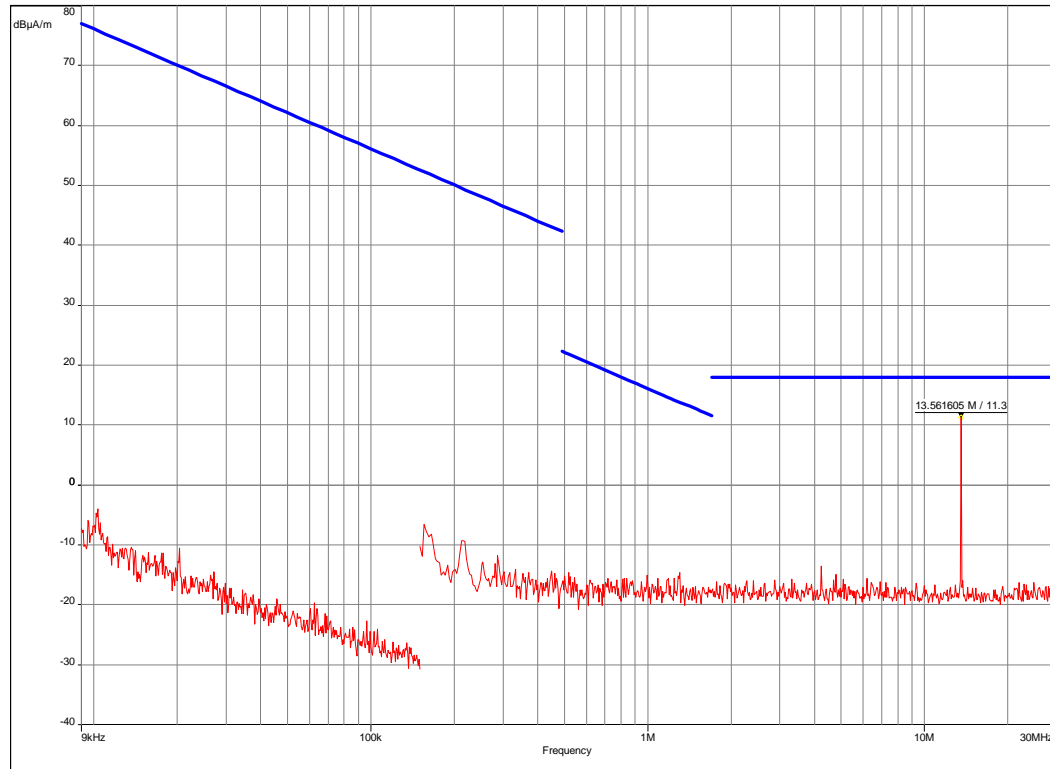
Front side / antenna 45°

Classe:

Detection: Peak

09/02/2010

— RADIO/FCC part15.209 (40dB/dec) - Class:ss - Crête/3.0m/
— Mes. Peak
○ Peak/LimPeak



Front side / antenna 45° - 02/09/2010 10:29 - 917

Limit indicated on this plot is calculated with 40 dB/decade extrapolation factor and 51.5 dB conversion factor.

Radiated magnetic field emission (Pre-measurement)

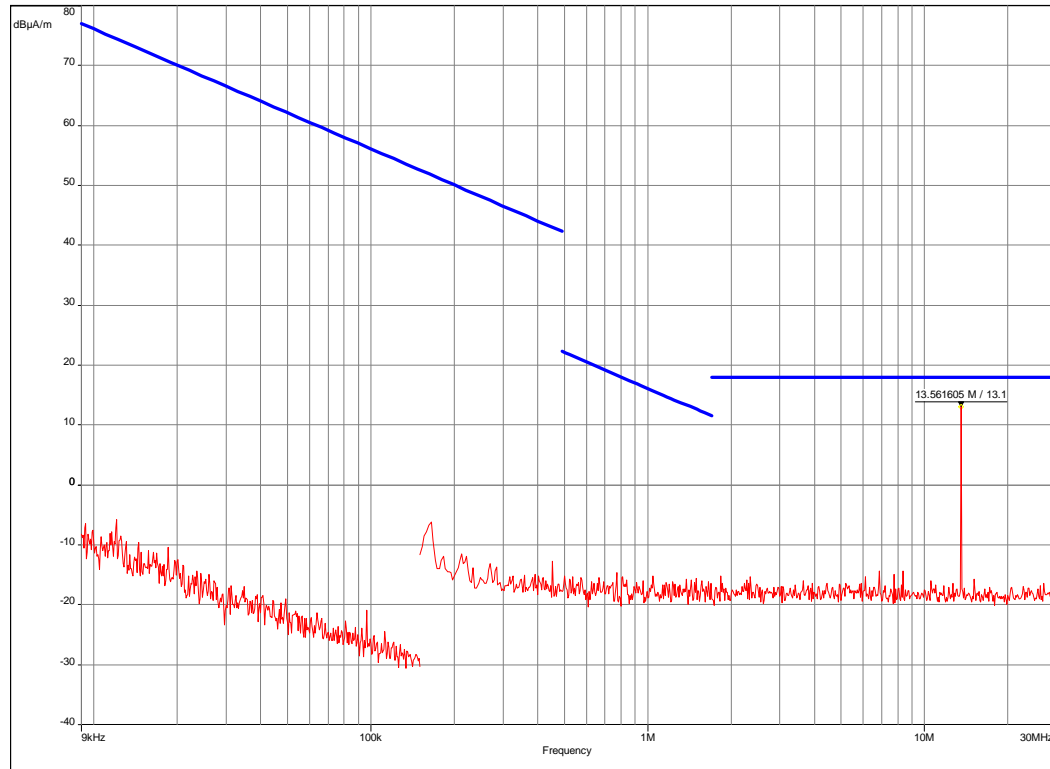
Front side / antenna 90°

Classe:

Detection: Peak

09/02/2010

— RADIO/FCC part15.209 (40dB/dec) - Class:ss - Crête/3.0m/
— Mes. Peak
○ Peak/LimPeak



Front side / antenna 90° - 02/09/2010 10:36 - 918

Limit indicated on this plot is calculated with 40 dB/decade extrapolation factor and 51.5 dB conversion factor.

Radiated electric emission (Pre-measurement)

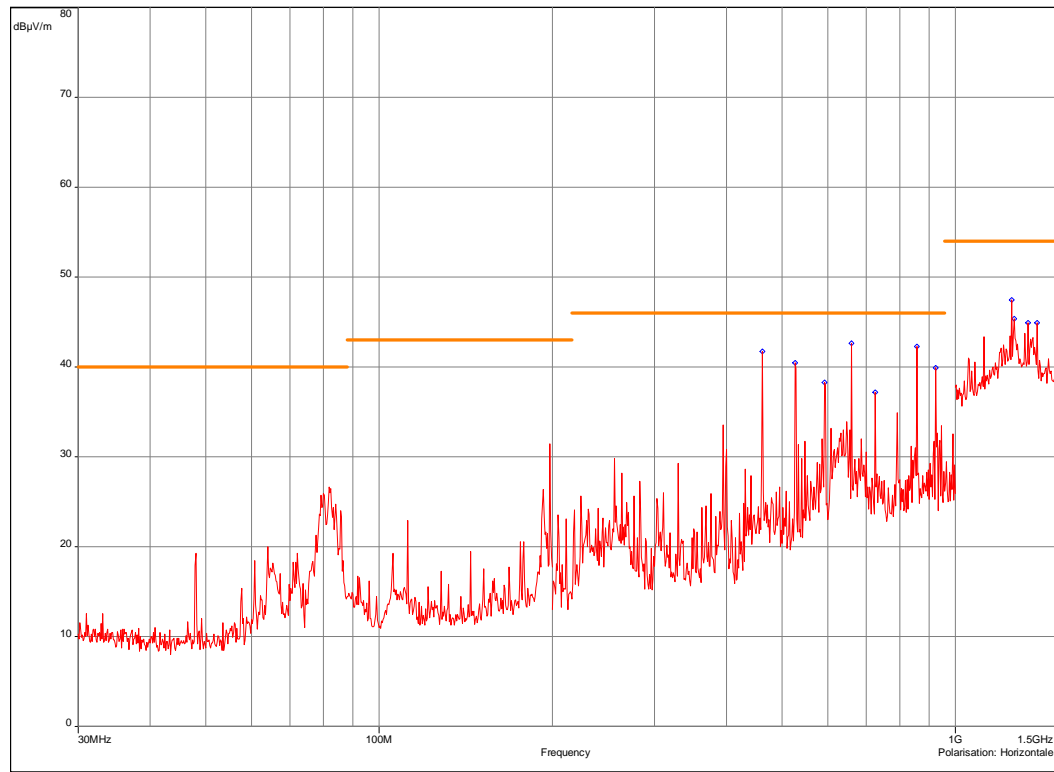
Front side

Classe: B of the standard

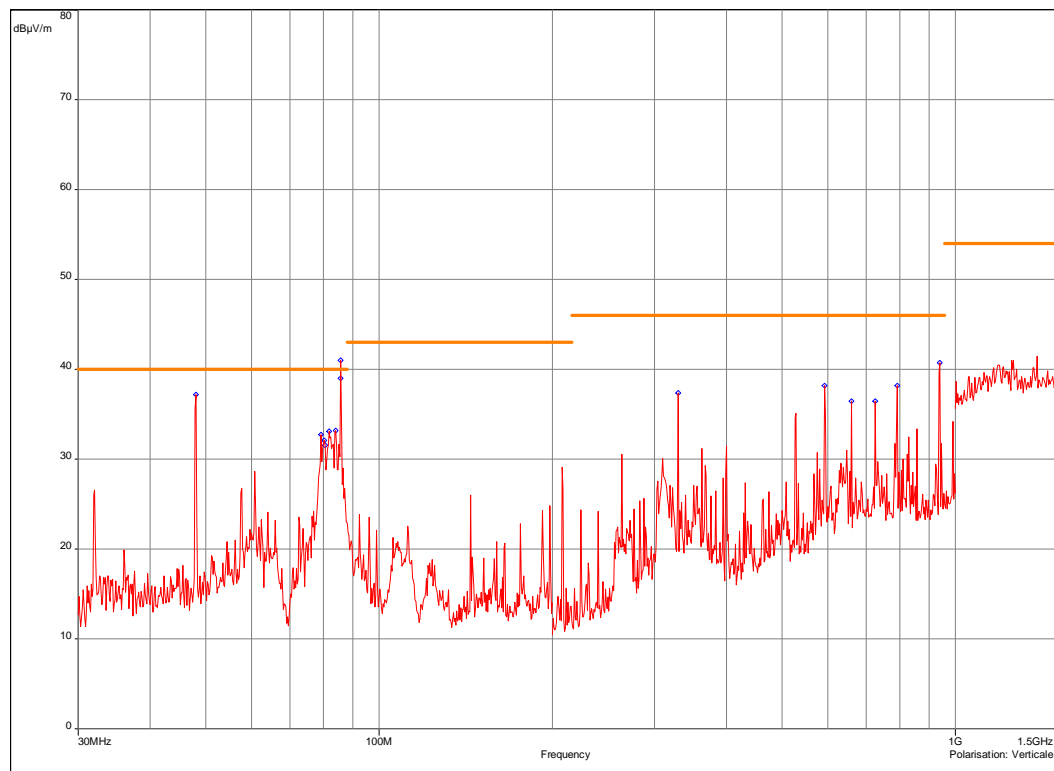
Detection: Peak

09/02/2010

— C.E.M. (civil)/FCC Part.15 générales - Class:B - QCrête/3.0m/
— Mes.Peak (Horizontale)
♦ Peak/LimQ-Peak (Horizontale)



— C.E.M. (civil)/FCC Part.15 générales - Class:B - QCrête/3.0m/
— Mes.Peak (Verticale)
♦ Peak/LimQ-Peak (Verticale)



c) Final radiated electric emission on Open Area Test Site

Test configuration:

Frequency band	Tested side	Resolution bandwidth	Video bandwidth	Detection mode	E.U.T. height
30MHz-1GHz	(Open area measurement)	120kHz	300kHz	Quasi peak	3cm
1GHz-1.5GHz	(Open area measurement)	1MHz	3MHz	Average	3cm

Measurement has been performed to 10th harmonic of higher internal frequency of the system.

For each measured frequencies, E.U.T. is set via a turntable in order to find the highest level. Test antenna is set between 1m and 4m in order to find the highest level in vertical and horizontal polarization.

Only highest levels are recorded.

E.U.T. is powered at its nominal power supply. E.U.T. power supply is monitored via a multimeter.

Test equipment list (Open area measurement):

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	3115	1053
Antenna	Electro-Metrics	BIA-30HF	1107
Antenna	Rohde & Schwarz	HL223	3126
Antenna mast	Heinrich Deisel	HD100	4036
Antenna mast	Heinrich Deisel	MA240	4037
Cable		N-1m	2704
Cable		N-17m	3620
Cable		N-5m	2720
Cable		N-8m	3694
Open area test site	Emitech	Salinelles	3482
Preamplifier	Microwave	C005180F-4B1	2165
Preamplifier	Mini-circuit	ZFL-1000LN	1119
Receiver	Agilent Technologies	E7405A	2161
Turntable	Heinrich Deisel	D4420	4038

Results: See Board(s) hereafter

FAREBOX FBE420 24VDC POWER SUPPLY

Frequency (MHz)	Polarization	Azimet (degrees)	Antenna height (cm)	Measure (dBμV/m)	Standard limit (dBμV/m)	Comments
47.98	Vertical	0	145	36.31	40	C
85.74	Vertical	360	300	33.16	40	C
330.00	Vertical	100	200	26.02	46	C
593.92	Vertical	180	200	40.46	46	C
659.92	Vertical	320	200	41.39	46	C
725.92	Vertical	320	200	38.10	46	C
791.84	Vertical	320	200	41.38	46	C
938.00	Vertical	0	100	<44.95(*)	46	C
461.93	Horizontal	0	142	44.031	46	C
527.84	Horizontal	44	136	44.29	46	C
593.92	Horizontal	122	136	43.65	46	C

Frequency (MHz)	Polarization	Azimut (degrees)	Antenna height (cm)	Measure (dBμV/m)	Standard limit (dBμV/m)	Comments
659.92	Horizontal	0	107	41.93	46	C
725.92	Horizontal	90	100	38.39	46	C
857.92	Horizontal	207	100	40.37	46	C
923.92	Horizontal	35	255	35.86	46	C
1253.8	Horizontal	29	208	42.67	54	C
1339.64	Horizontal	0	200	35.77(**)	54	C

C= Compliant

NC= Not compliant

(*) Lower than this value wich is ambient GSM for related frequency.

(**) Background noise

All other radiated emissions are very lower than limit.

8. OPERATION WITHIN THE BAND 13.110-14.010 MHZ – SECTION 15.225

a) Field strength

Standard: FCC part 15 Subpart C 15.225 (07/2008)

Test method: ANSI C63.4:2003

Test configuration:

Frequency band	Tested side	Resolution bandwidth	Video bandwidth	Detection mode	E.U.T. height
13.11MHz-14.01MHz	Front side / antenne 0°	10kHz	30kHz	Peak	3cm
13.11MHz-14.01MHz	Front side / antenne 45°	10kHz	30kHz	Peak	3cm
13.11MHz-14.01MHz	Front side / antenne 90°	10kHz	30kHz	Peak	3cm

Measure is done with an antenna position of 0°, 90° and 45°.

Test method deviation:

Measurements are given in dBμA/m instead of dBμV/m (conversion factor: 51.5 dB)

Measuring distance is 3 or 10 meters instead of 30 m

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Rohde & Schwarz	HFH2-Z2	5825
Cable	C&C	N-1.5m	5017
Cable	C&C	N-8m	5014
Receiver	Rohde & Schwarz	ESHS10	3371
Software	Nexio	BAT EMC	0000

BAT-EMC software version: V3.5.0.2

Results: See Graph(s) hereafter.

Carrier measurement at 10m: 0 dBμA/m (≈ 51.5 dBμV/m)

Using an extrapolation factor of 40 dB/decade (as described in section 15.31 (f)), the level is about 31.5 dBμV/m (40μV/m) for a limit at 15.848 mV/m.

Radiated magnetic field emission (measurement)

Front side 13.56MHz / antenna 90°

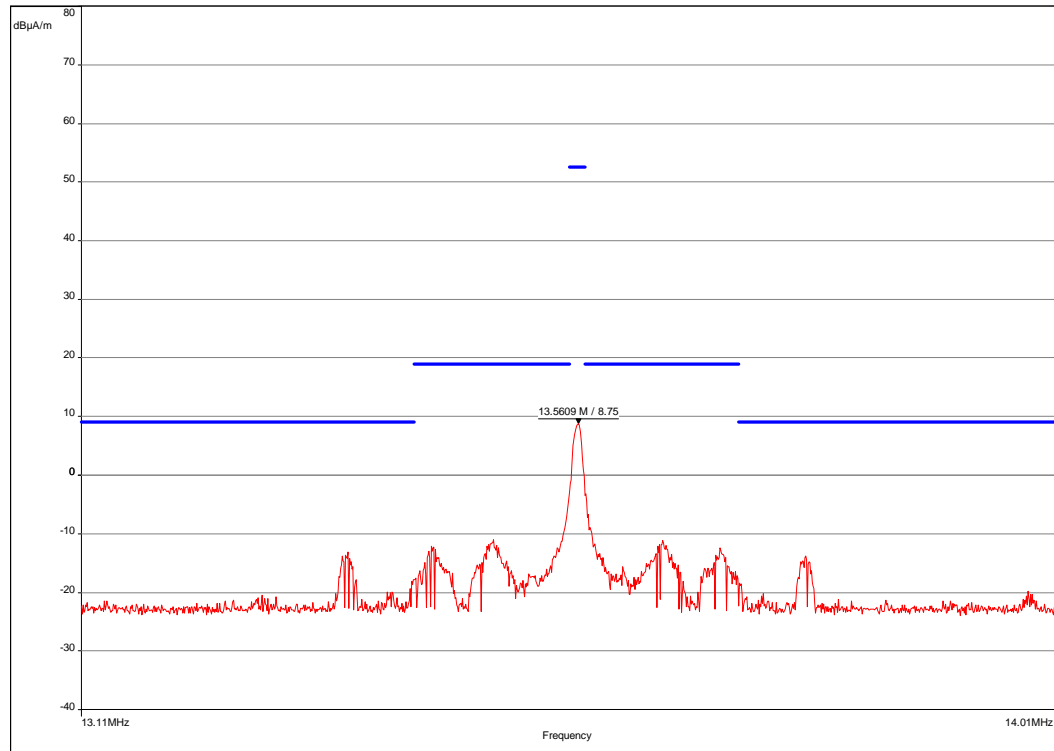
Classe: em of the standard

Detection: Peak

09/02/2010

Frequency : 13.11 MHz - 14.01 MHz (Step: 300 Hz)
 Settings: RBW: 10 kHz, VBW: 30 kHz, Holding time: 10 ms/Pt, sweep count 10
 Polarisation : Circulaire
 Distance: 3 m

RADIO/FOC Part.15 (13.56MHz) - Class:em - QCRéte/3.0m/
 Mes.Peak



Front side 13.56MHz / antenna 90° - 02/09/2010 10:41 - 919

Radiated magnetic field emission (measurement)

Front side 13.56MHz / antenna 45°

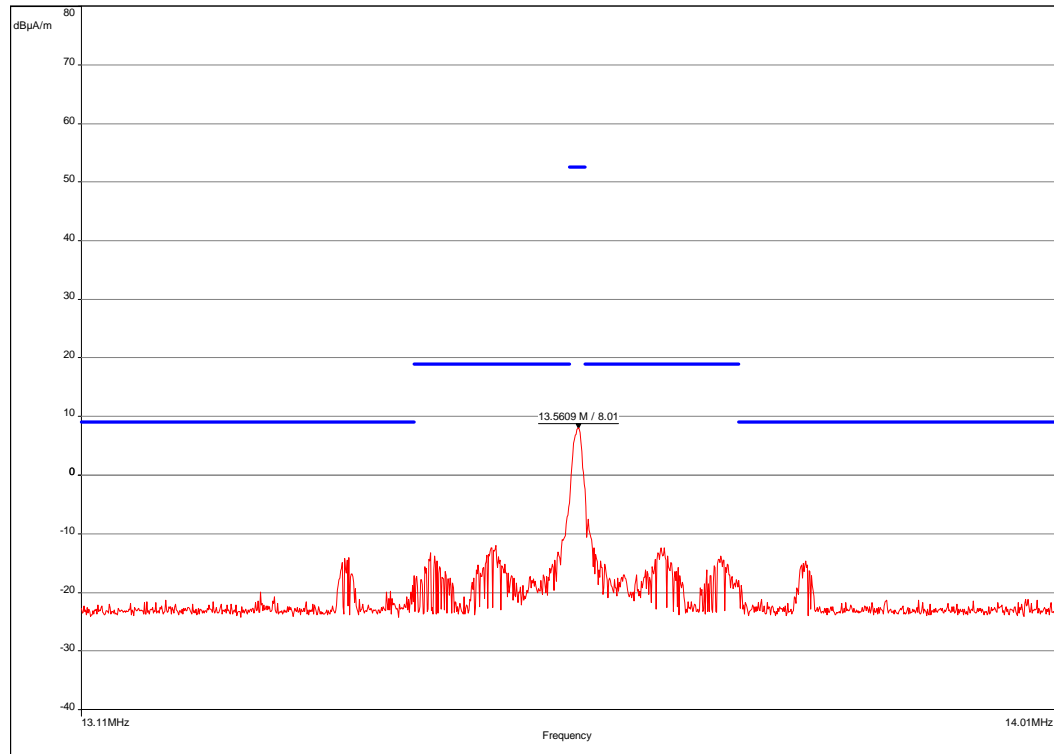
Classe: em of the standard

Detection: Peak

09/02/2010

Frequency : 13.11 MHz - 14.01 MHz (Step: 300 Hz)
Settings: RBW: 10 kHz, VBW: 30 kHz, Holding time: 10 ms/Pt, sweep count 5
Polarisation : Circulaire
Distance: 3 m

RADIO/FOC Part.15 (13.56MHz) - Class:em - QCRéte/3.0m/
Mes.Peak



Front side 13.56MHz / antenna 45° - 02/09/2010 11:10 - 920

Radiated magnetic field emission (measurement)

Front side 13.56MHz / antenna 0°

Classe: em of the standard

Detection: Peak

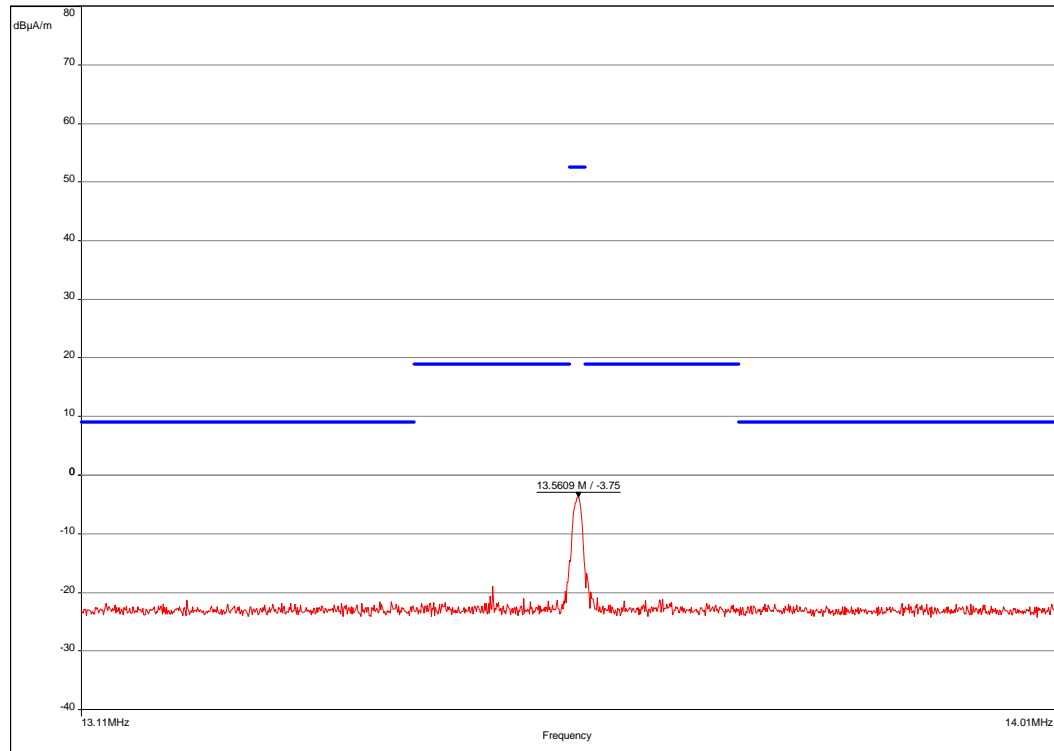
09/02/2010

Frequency : 13.11 MHz - 14.01 MHz (Step: 300 Hz)

Settings: RBW: 10 kHz, VBW: 30 kHz, Holding time: 10 ms/Pt, sweep count 5

Polarisation : Circulaire
Distance: 3 m

RADIO/FOC Part.15 (13.56MHz) - Class:em - QCrite/3.0m/
Mes.Peak



Front side 13.56MHz / antenna 0° - 02/09/2010 11:18 - 921

9. FREQUENCY TOLERANCE – SECTION 15.225

Standard: FCC part 15 Subpart C 15.225 (07/2008)

Test method: ANSI C63.4:2003

Test configuration: A near field probe detects field near equipment (relative measurement).

Resolutions:

Frequencies	Resolution bandwidth	Video bandwidth
13.56MHz	3Hz	10Hz

Test method deviation: E.U.T. is powered by 24Vdc power voltage. However due to size of equipment, only electronic radio board was inside the shielded chamber. This board is powered by 24Vdc only by a regulated DC/DC power supply. So test was done at normal supply voltage only.

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Power supply	KIKUSUI	PCR2000L	0800
Spectrum analyser	Agilent Technologies	E4440A	5824
Antenn4	Emitech	3.5 cm	4653
Climatic enclosure	Secasi	SM600C	1670
Multimeter	Agilent	U1252A	6138

Standard limits: +/- 0.01% of the operating frequency

Results: See Board(s) below

E.U.T. operating mode: without modulation

		Power supply	Measured Frequency (MHz)	Frequency tolerance (kHz)	Limit (kHz)
Normal condition	Temperature 20°C Humidity 31%	24Vdc	13.560600	-	+/-1.35606
		20.4Vdc	N.P.	-	
		27.6Vdc	N.P.	-	
Extreme condition	Minimum Temperature -20°C	24Vdc	13.560717	+0.117	
		20.4Vdc	N.P.	-	
		27.6Vdc	N.P.	-	
	Maximum Temperature +50°C	24Vdc	13.560575	-0.025	
		20.4Vdc	N.P.	-	
		27.6Vdc	N.P.	-	



N.P.: Not Performed.

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

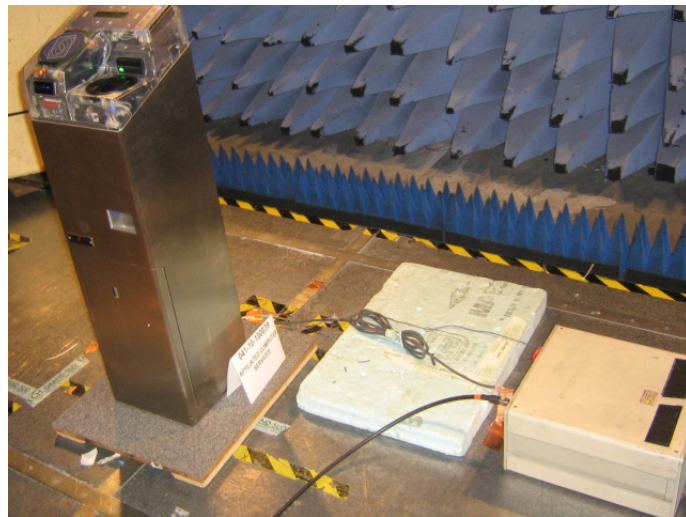
ANNEX: PHOTOGRAPH(S)

EQUIPEMENT UNDER TEST (E.U.T.) PHOTOGRAPH(S)

FAREBOX FBE420

<p>E.U.T. Marking plate</p>	
<p>Radiated electric field emission on OATS</p>	

Conducted emission



Frequency tolerance

