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RA-24-07102552-1/A Ed. 0

FCC CERTIFICATION
RADIO Measurement
Technical Report

standard to apply:
FCC Part 15.247

Equipment under test:
TICKET MACHINE
STRADA BNA WIFI

FCC ID:
T2X-STRADA-BNA

Company:
PARKEON

DISTRIBUTION: Mr EPENOY **Company: PARKEON**

Number of pages: 37 including 3 annexes

Ed.	Date	Modified pages	Written by Name	Visa	Technical Verification Quality Approval Name	Visa
0	9-Jul-07	Creation	L. BERTHAUD	LB	P. BONNENFANT	

Duplication of this document is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.
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:	**TICKET MACHINE**
Reference / model:	STRADA BNA WIFI
Serial number:	not communicated
MANUFACTURER:	not communicated

COMPANY SUBMITTING THE PRODUCT:

Company:	PARKEON
Address:	Parc Lafayette 6, rue Isaac Newton 25075 BESANCON CEDEX 9 FRANCE
Responsible:	Mr EPENOY
DATE(S) OF TEST:	12, 13 and 14 June 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: TICKET MACHINE STRADA BNA WIFI in accordance with normative reference.

2. PRODUCT DESCRIPTION

ITU Emission code: 13M0G7D

Class: B (residential environment)

Utilization: ticket machine with Wifi module

Antenna type: dedicated antenna

Operating frequency range: from 2412 MHz to 2462 MHz

Number of channels: 11

Channel spacing: 5 MHz

Frequency generation: O SAW Resonator O Crystal ⊙ Synthetiser

Modulation: Digital Transmission System (DTS)
O Amplitude ⊙ Digital O Frequency O Phase

Power source: 115 Va.c. (mains) or 12 Vd.c. (solar pannel + battery)

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 (2006)	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 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 2400-2483.5 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

Test procedure	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				*Note 5*
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 2400-2483.5 MHz					
	(a) (1) *hopping systems*			X		
	(a) (2) *digital modulation techniques*	X				*Note 6*
	(b) *max output power*	X				*Note 3*
	(c) *operation with directional antenna gains > 6 dBi*			X		*Note 1*
	(d) *intentional radiator*	X				
	(e) *peak power spectral density*	X				
	(f) *hybrid system*			X		
	(g)			X		
	(h)			X		
	(i) *RF exposure compliance*	X				*Note 4*
DA 00-705	BAND EDGE COMPLIANCE	X				

NAp: Not Applicable NAs: Not Asked

Note 1: the antenna gain is less than 6 dBi.

Note 2: see FCC part 15.247 (d).

Note 3: conducted measurement is not possible (integral antenna), so we used the radiated method in open field.

Note 4: 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).

Note 5: dedicated antenna (see photos in annex 2).

Note 6: the minimum 6 dB bandwidth is at least 500 kHz (see annex 1).

Conclusion:

The sample of TICKET MACHINE STRADA BNA WIFI 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 15.207

Limits: Class B

Test equipment:

TYPE	BRAND	EMITECH NUMBER
AC Power supply ALT 2000	K. SERRAS	2441
Test receiver ESH3	Rohde & Schwarz	1058
Pulse limiter ESH3-Z2	Rohde & Schwarz	976
Artificial main network L3-25	PMM	834
Spectrum analyzer FSBS	Rohde & Schwarz	3133

Software used: BAT-EMC V3.1.7.1

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.

See photos in the annex 1.

Equipment under test operating condition:

The equipment is powered with the AC power operating voltage of 115 V / 60 Hz.

The equipment under test is in continuous Wifi emission / reception, with an access point, connected to a computer.

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak / Average

Bandwidth: 9 kHz

Results:

Measurement on the mains power supply:

The measurement is made with peak detector.

Curve N° 1: measurement on the Neutral with peak detector
Curve N° 2: measurement on the Line with peak detector

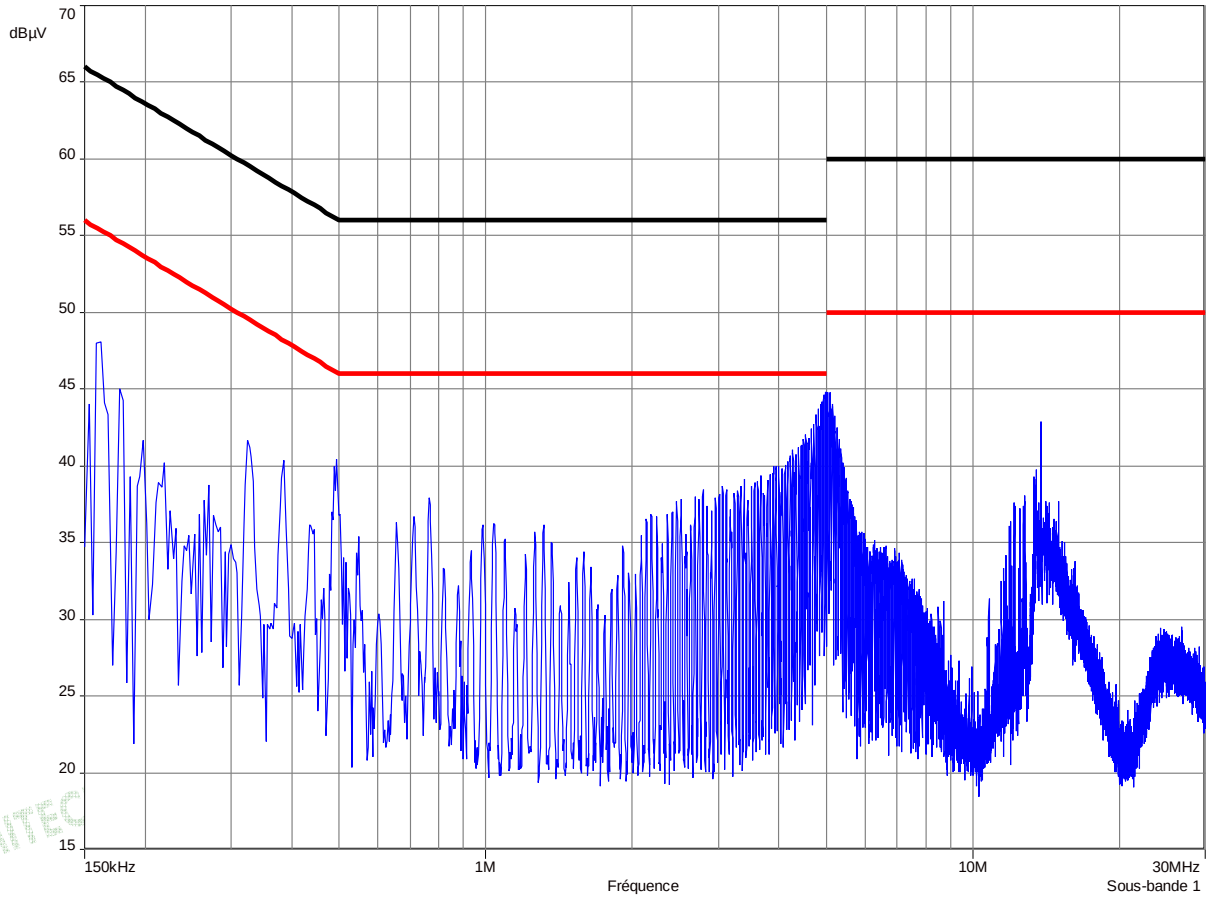
The frequencies which are not 6 dB under the Quasi-Peak limit are analyzed with Quasi-Peak and Average detector, if necessary.
The results are noted in the following curves.

Curve N° 3: average measurement on the neutral, for the frequency ranges: 150 kHz – 500 kHz, 1.5 MHz – 2 MHz and 3.7 MHz – 5.7 MHz

Curve N° 4: average measurement on the line, for the frequency ranges: 150 kHz – 500 kHz, 1.5 MHz – 2 MHz and 3.7 MHz – 5.7 MHz

CURVE N°: 1.

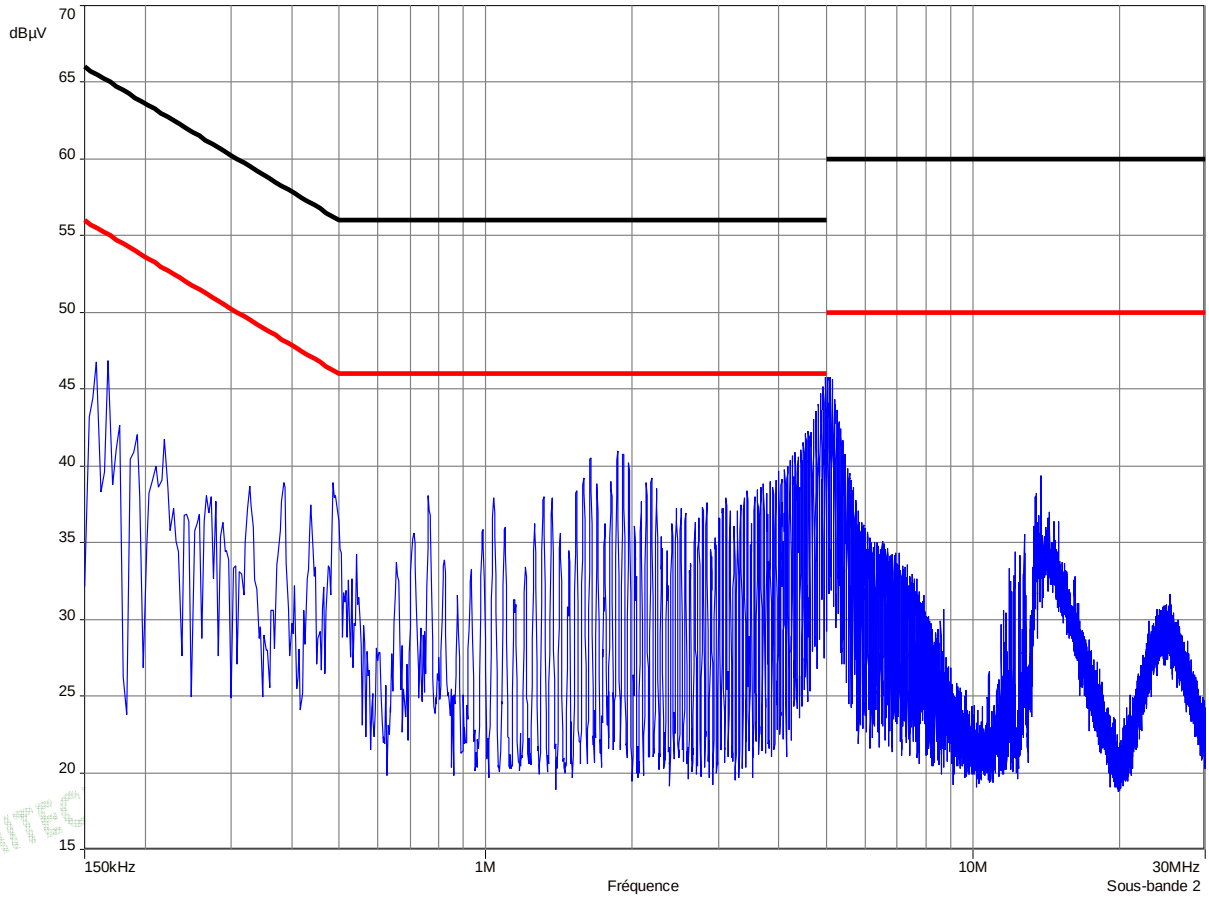
Measurement on the neutral with peak detector



RBW = 10 kHz
VBW = 10 kHz
Sweep time = 500 ms/MHz

CURVE N°: 2.

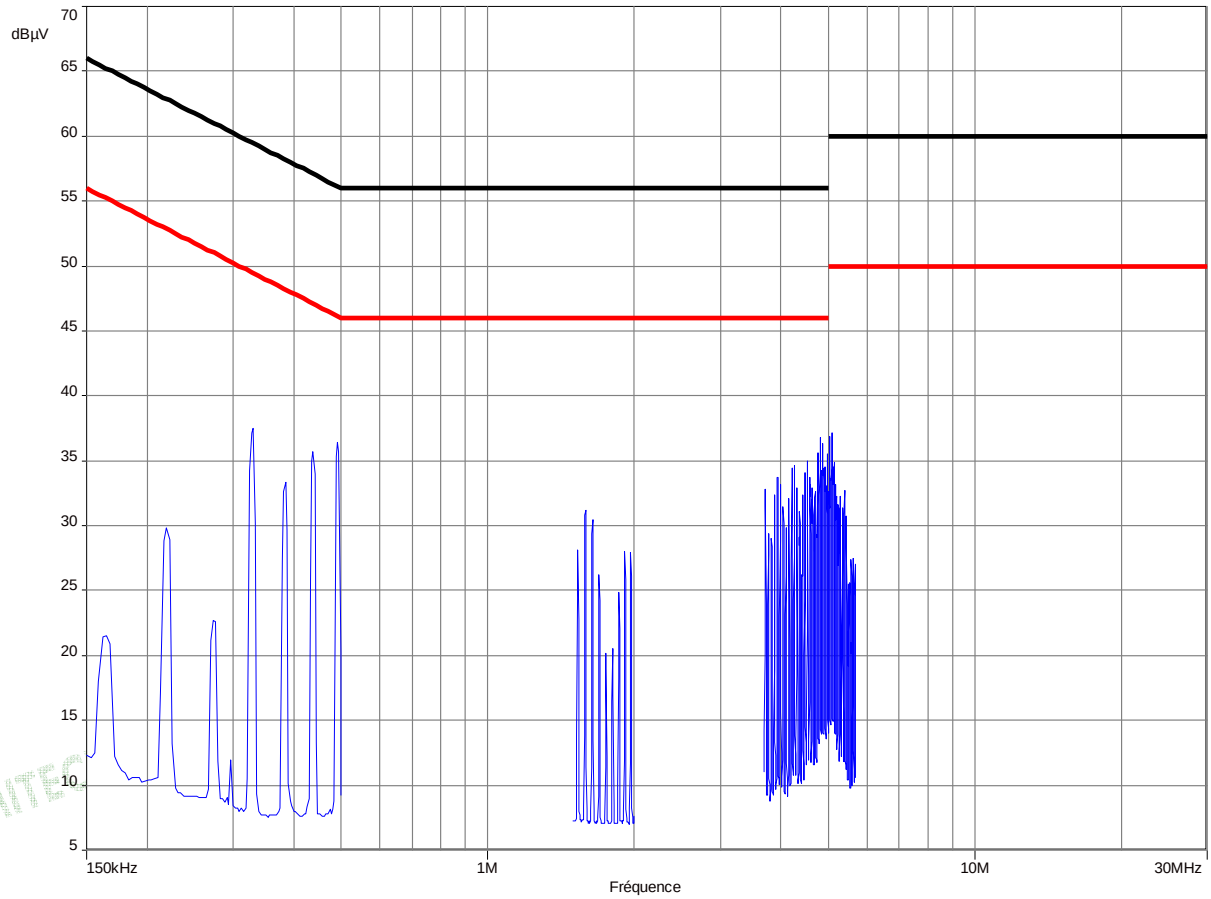
Measurement on the line with peak detector



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

CURVE N°: 3.

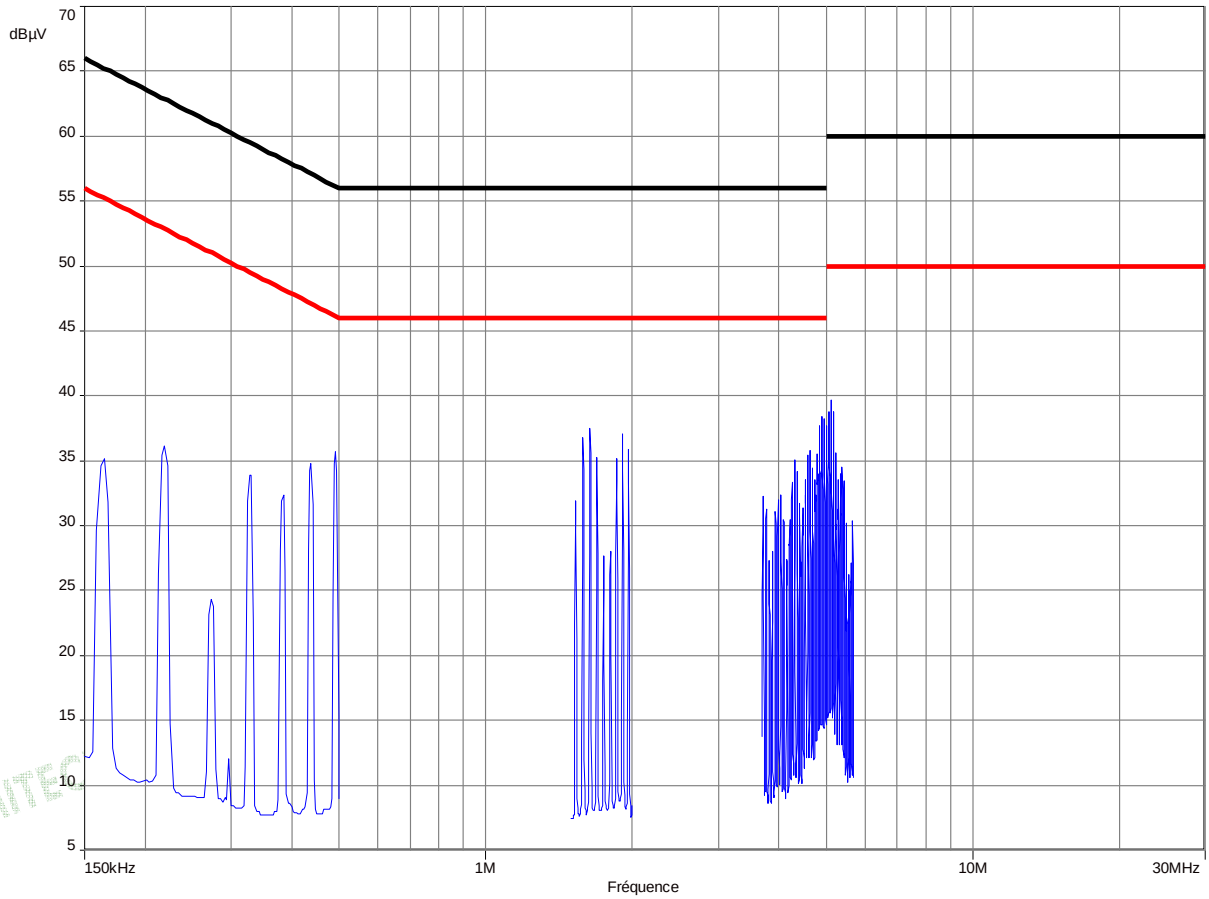
Average measurement on the neutral, for the frequency ranges:
150 kHz – 500 kHz, 1.5 MHz – 2 MHz and 3.7 MHz - 5.7 MHz



RBW = 10 kHz
Sweep time = 500 ms/pts

CURVE N°: 4.

Average measurement on the line, for the frequency ranges:
150 kHz – 500 kHz, 1.5 MHz – 2 MHz and 3.7 MHz - 5.7 MHz



RBW = 10 kHz
Sweep time = 500 ms/pts

8. PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Diode detector ODZ0004A	Omniyig	2469
Oscilloscope THS 720	Tektronix	0940
Antenna RGA60	Electrometrics	1938
Antenna RGA60	Electrometrics	1204
Open site	EMITECH	1274
Radio frequency generator SME06	Rohde & Schwarz	1669
High pass filter HPM11630	Micro-tronics	1673
Low-noise amplifier 1 to 18 GHz	ALC	2648
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Variac R213	Dereix	1419
Multimeter 77-2	Fluke	812

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 and substitution method. 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.

The spectrum analyzer is first replaced by a calibrated wideband power meter and the level is recorded.
The equipment under test is then substituted by a signal generator with a calibrated double ridged guide antenna, and its level adjusted to obtain the same power level as the equipment under test.
The output power level of the signal generator is finally measured with a calibrated RF power meter.

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): 24
Relative humidity (%): 68

Sample n° 1 mains

Channel 1 (2412 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	Nominal power source (V): 115	79.36	4.75	29.16	113.27	63.697×10^{-3}	1

Channel 6 (2437 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	Nominal power source (V): 115	77.68	4.75	29.16	111.59	43.263×10^{-3}	1

Channel 11 (2462 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	Nominal power source (V): 115	77.22	4.75	29.16	111.13	38.915×10^{-3}	1

* $P = (E \times d)^2 / (30 \times Gp)$ with d = 3 m and Gp = 1

Sample n° 1 solar pannel + battery

Channel 1 (2412 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	Nominal power source (V): 12	80.86	4.75	29.16	114.77	89.975×10^{-3}	1

Channel 6 (2437 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	Nominal power source (V): 12	80.35	4.75	29.16	114.26	80.006×10^{-3}	1

Channel 11 (2462 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)
Normal test conditions	Nominal power source (V): 12	79.83	4.75	29.16	113.74	70.978×10^{-3}	1

* $P = (E \times d)^2 / (30 \times Gp)$ with d = 3 m and Gp = 1

Test conclusion:

RESPECTED STANDARD

9. PEAK POWER DENSITY

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipment used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Open site	Emitech	1274
Radiofrequency generator SME06	Rohde & Schwarz	1669
Antenna RGA-60	Electrometrics	1938
Antenna RGA-60	Electrometrics	1204
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Variac R213	Dereix	1419
Multimeter 77-2	Fluke	0812

Measured condition:

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 is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 24
Relative humidity (%): 68

Sample n° 1 mains

Channel 1

	Peak power density at frequency: 2412 MHz
Normal test conditions	-13.61 dBm
Limits	+8 dBm

Channel 6

	Peak power density at frequency: 2437 MHz
Normal test conditions	-19.41 dBm
Limits	+8 dBm

Channel 11

	Peak power density at frequency: 2462 MHz
Normal test conditions	-16.41 dBm
Limits	+8 dBm

Sample n° 1 solar pannel + battery

Channel 1

	Peak power density at frequency: 2412 MHz
Normal test conditions	-8.51 dBm
Limits	+8 dBm

Channel 6

	Peak power density at frequency: 2437 MHz
Normal test conditions	-10.01 dBm
Limits	+8 dBm

Channel 11

	Peak power density at frequency: 2462 MHz
Normal test conditions	-9.81 dBm
Limits	+8 dBm

Test conclusion:

RESPECTED STANDARD

10. RADIATED EMISSION OF TRANSMITTER

Standard: FCC Part 15

Test procedure: paragraph 15.205
paragraph 15.209
paragraph 15.247

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
Low-noise amplifier 2 to 18 GHz	Microwave DB	1922
High pass filter HP12/3200-5AA	Filtek	
Antenna WR42	IMC	1939
Low-noise amplifier 18 to 26 GHz	ALC	3036
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419

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 ($F_{carrier} \leq 10$ GHz)

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 is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 24
Relative humidity (%): 65

Power source: 12 Vd.c. (mains)

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

Channel 1

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)
77.42	Peak	170	0	100	V	31.5	93.27	61.77
165.89	Peak	100	17	100	V	20	63.52*	43.52

Channel 6

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)
77.42	Peak	170	0	100	V	31.5	93.27	61.77
165.89	Peak	100	17	100	V	20	63.52*	43.52

Channel 11

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)
77.42	Peak	170	0	100	V	31.5	93.27	61.77
165.89	Peak	100	17	100	V	20	63.52*	43.52

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section. The peak level recorded is below the average limit (Peak limit = Average limit + 20 dB).

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 113.27 dBµV/m on channel 1.

So the applicable limit is **93.27 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)).

Power source: 115 Va.c. (solar panel + battery)

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

Channel 1

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)
77.42	Peak	127	27	100	V	37	94.77	57.77
165.89	Peak	160	0	100	V	25.9	63.52*	37.62

Channel 6

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)
77.42	Peak	127	27	100	V	37	94.77	57.77
165.89	Peak	160	0	100	V	25.9	63.52*	37.62

Channel 11

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)
77.42	Peak	127	27	100	V	37	94.77	57.77
165.89	Peak	160	0	100	V	25.9	63.52*	37.62

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section. The peak level recorded is below the average limit (Peak limit = Average limit + 20 dB).

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 114.77 dBµV/m on channel 1.

So the applicable limit is **94.77 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. BAND EDGE COMPLIANCE

Standard: FCC Part 15.247

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

Test equipment used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Antenna RGA-60	Electrometrics	1204
Variac R213	Dereix	1419
Multimeter 77-2	Fluke	0812

Measured condition:

Requirements: Emissions that fall in the restricted bands (part 15.205). These emissions must be less than or equal to 500 µV/m (54 dBµV/m)/ Part 15.35b applies in the restricted bands.

Test procedure: An in band field strength measurement of the fundamental Emission using the RBw and detector function required by C63.4-2003 and FCC Rules.

Test operating condition of the equipment:

The equipment is blocked in continuous modulated transmission mode.

Results:

Lower Band Edge: from 2310 MHz to 2390 MHz, CURVES n° 5 and 6
Upper Band Edge: from 2483.5 MHz to 2500 MHz, CURVES n° 7 and 8

Sample n°1:

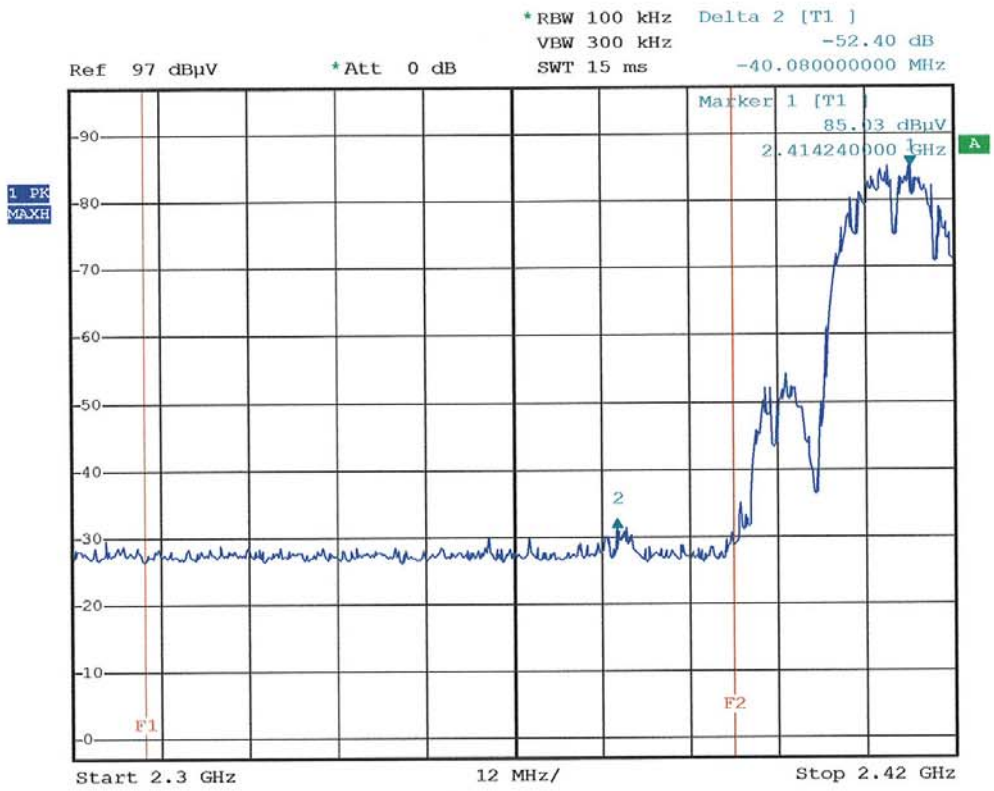
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out of Band Emission Level (dBµV/m)**	Limit (dBµV/m)	Margin (dB)
2412	113.27	Peak	2374.16	-52.4	60.87	74	13.13
2412	101.7	Average	2374.16	-51.94	49.76	54	4.24
2462	111.13	Peak	2499.1	-56.4	54.73	74	19.27
2462	99.35	Average	2495.3	-53.75	45.6	54	8.4

* 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

Test conclusion:

RESPECTED STANDARD

CURVE N°: 5.



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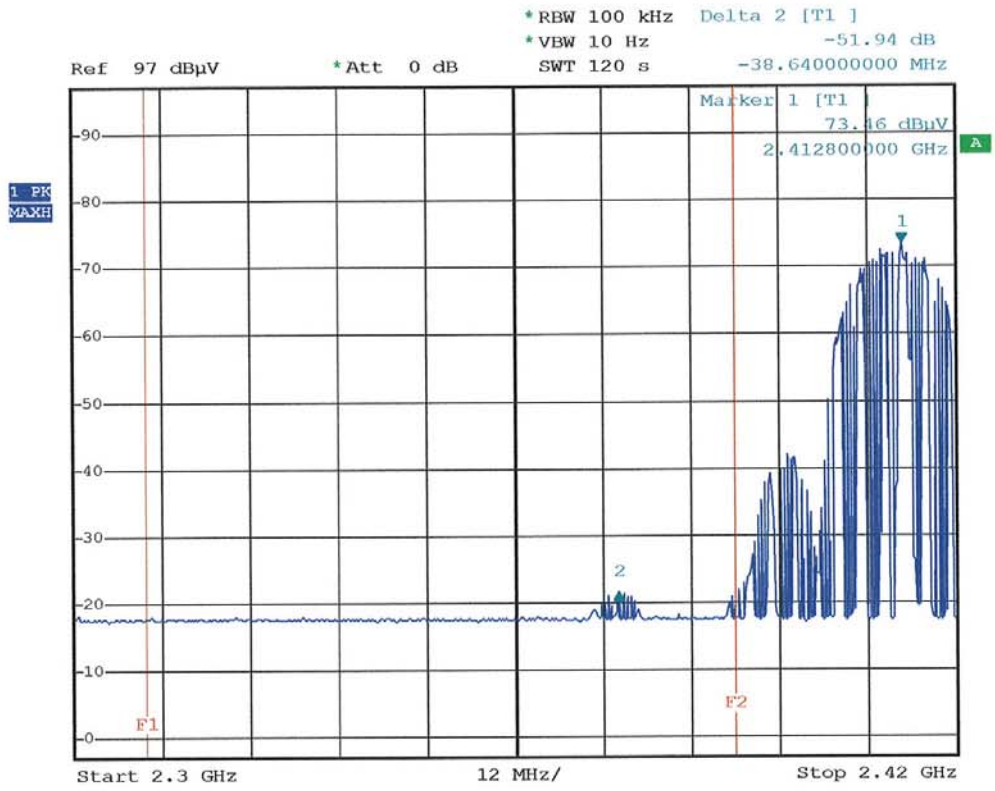
CURVE N°: 6.



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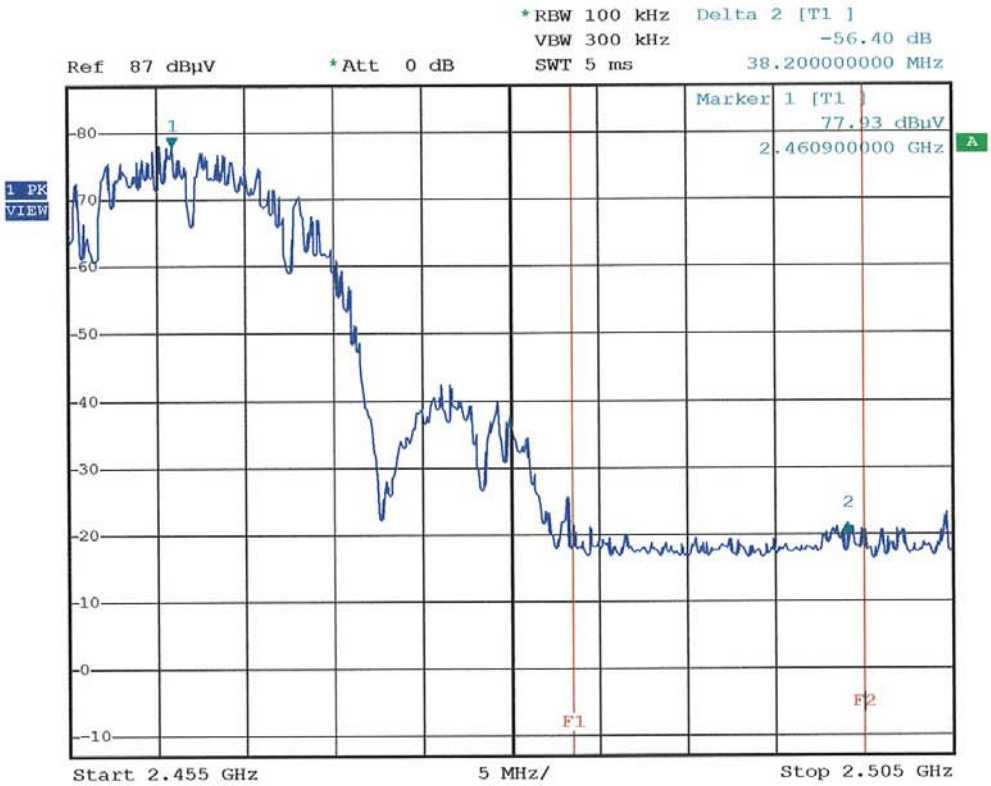

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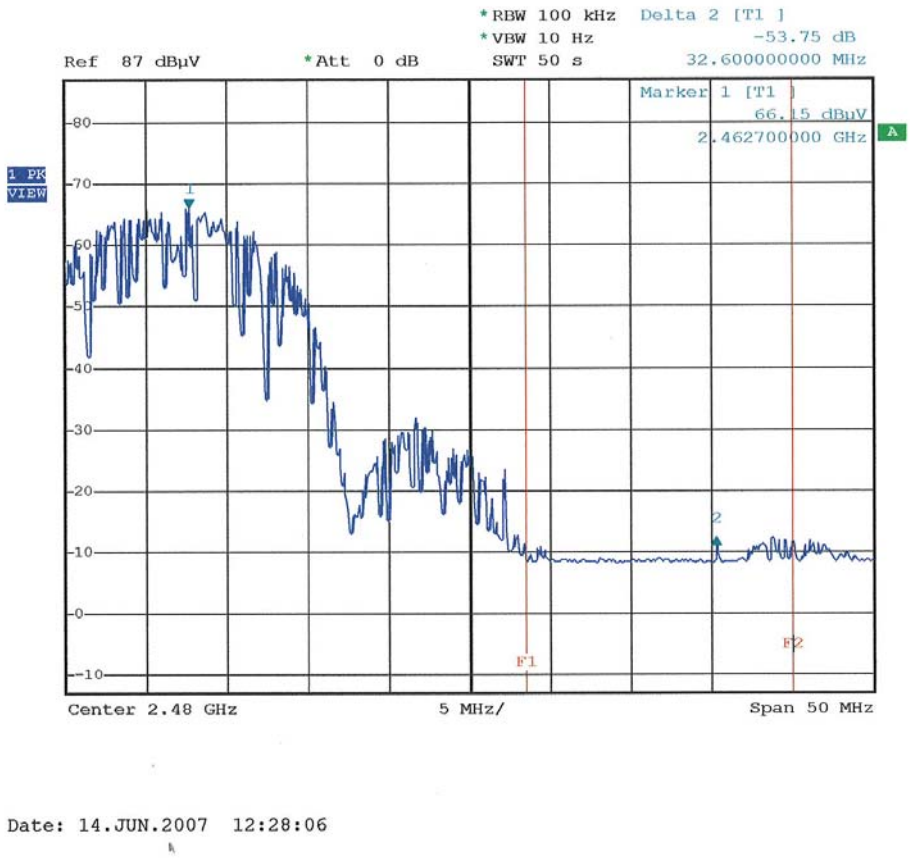

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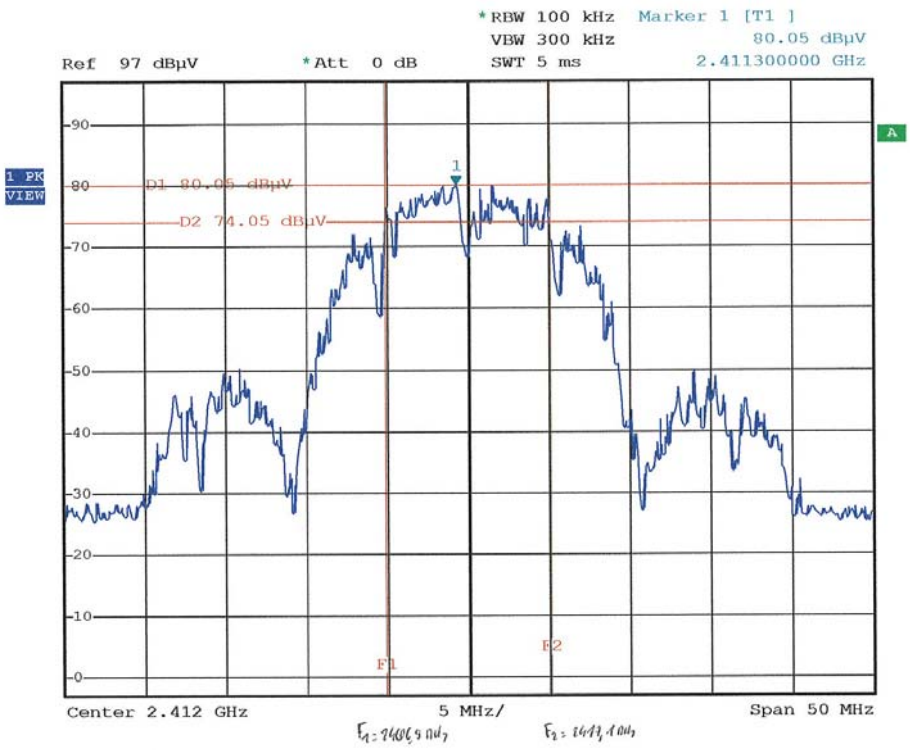
□□□ End of report, 3 annexes to be forwarded □□□

ANNEX 1: MINIMUM 6 dB BANDWIDTH



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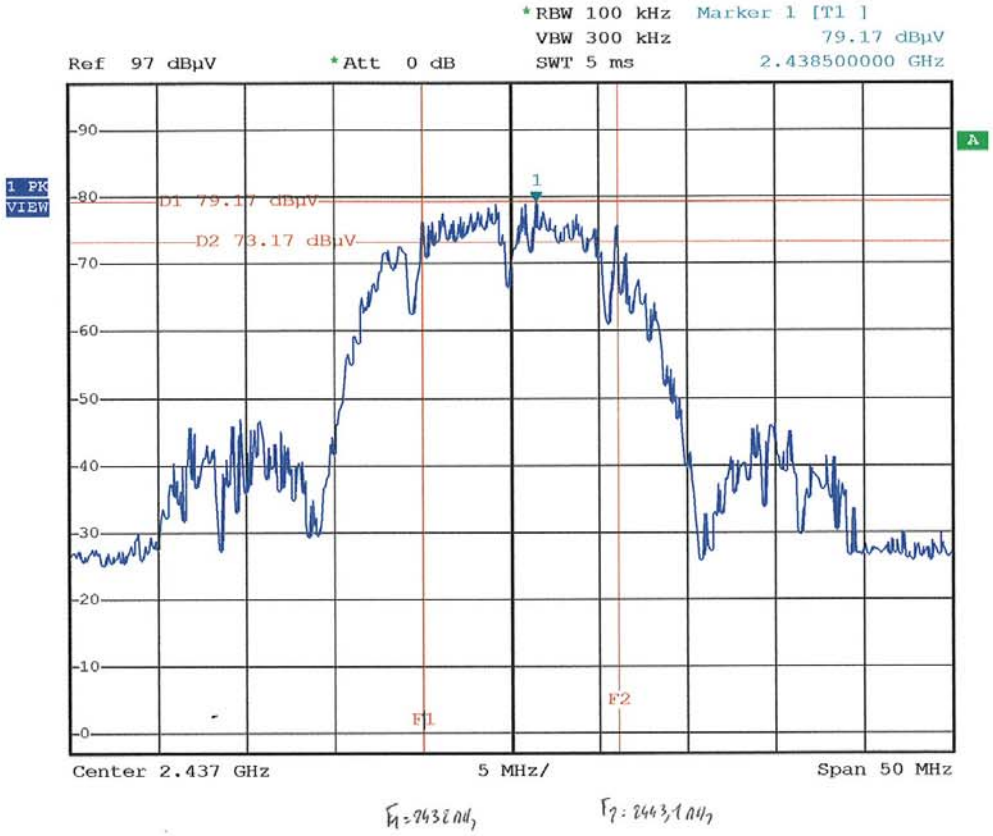

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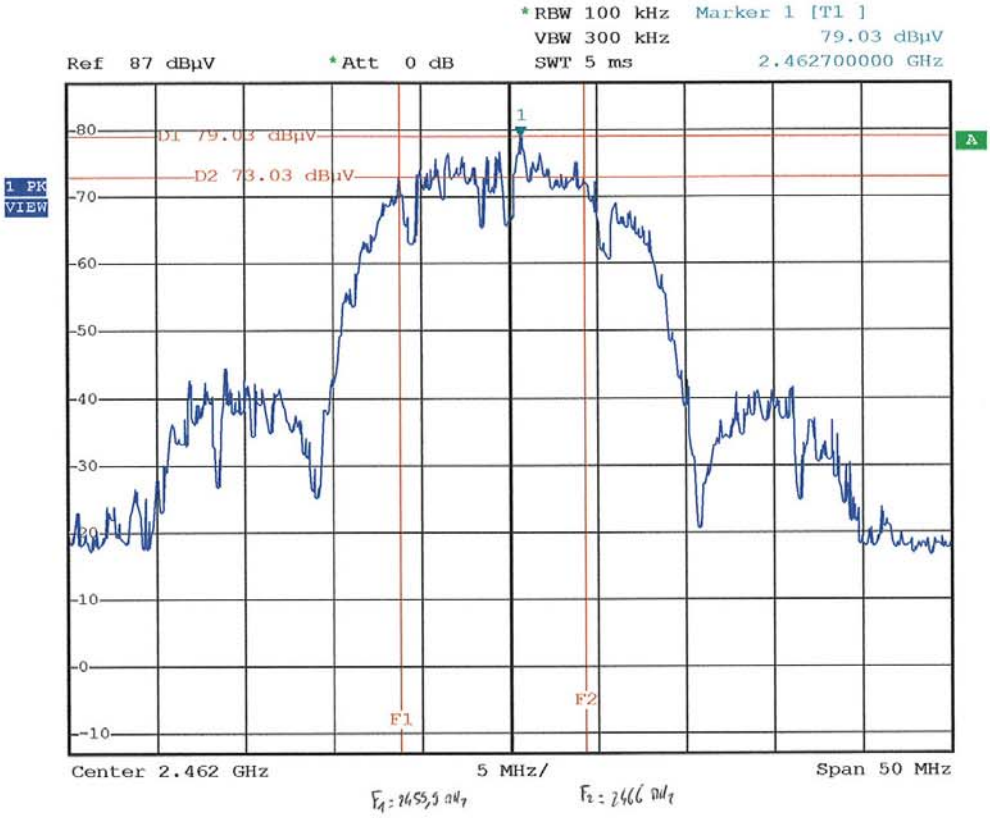

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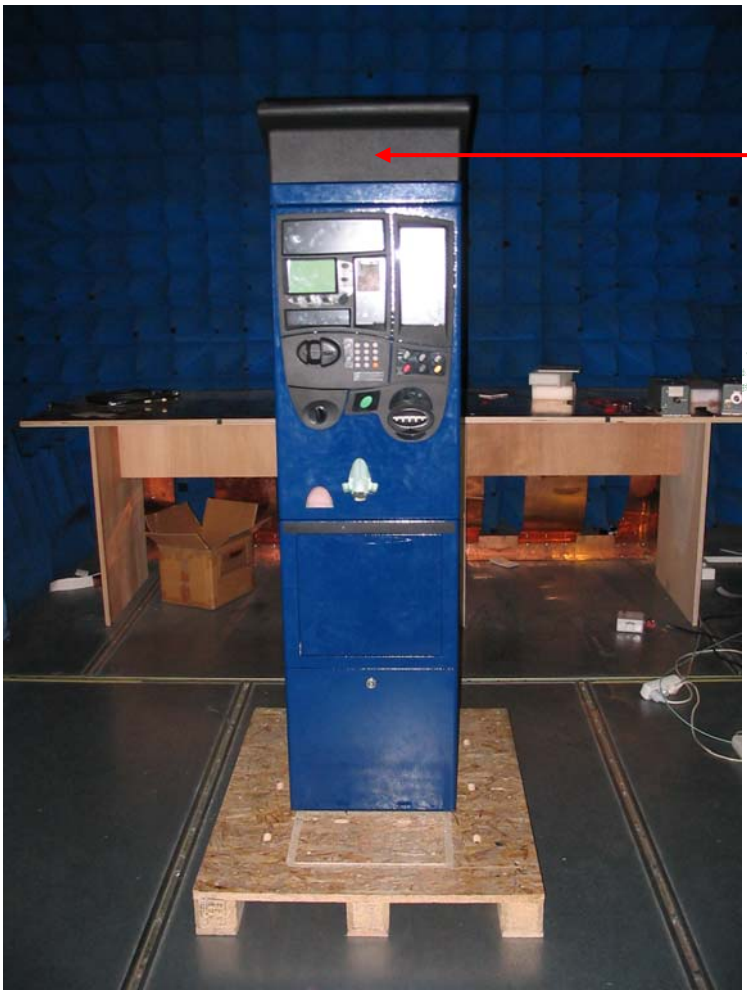
ANNEX 2: PHOTOS OF THE EQUIPMENT UNDER TEST

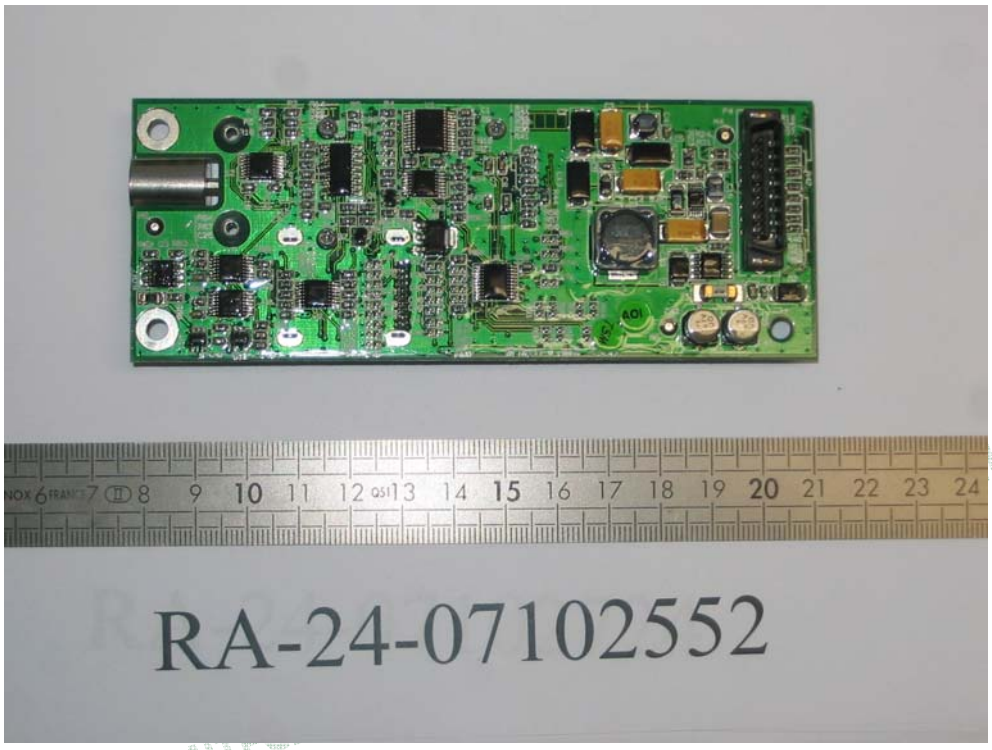
GENERAL VIEW (mains)

GENERAL VIEW (solar pannel)



Internal view

Radio module: face 1



Radio module: face 2

Antenna

ANNEX 3: TEST SET UP AND OPEN AREA TEST SITE

CONDUCTED MEASUREMENT SET UP

RADIATED MEASUREMENT SET UP

OPEN AREA TEST SITE