

RC-032-PTE-13-105155-1-A

E.M.C Test Report

According to the standards:

FCC PART 15 : 2013
 RSS-210 Issue 8 : 2010
 RSS-Gen Issue 3 : 2010

Equipment under test:

Wireless handheld payment terminal
 Type: IWL257
 FCC ID: XKB-IWL2XXWBCL
 IC: 2586D-IWL2WBCL

Company:
 INGENICO

FCC listed: 910 701
 IC listed: 4379

DISTRIBUTION: Mr GOBION

(Company: INGENICO)

Number of pages: 52 with 6 annexes

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TEST CERTIFICATION FOR: FCC Certification

NAME OF THE EQUIPMENT UNDER TEST: Wireless handheld payment terminal Type: IWL257

Serial number: 13086WL00000532

Reference / model (P/N): IWL257 – 01T2293A

Software version: SDK9.14

NAME OF THE MANUFACTURER: INGENICO

ADDRESS OF THE APPLICANT:

Company: INGENICO

Address: Bâtiment M2 Parc Innolin
10, rue du Golf
33700 MERIGNAC

Person in charge: Mr GOBION

DATES OF TESTS: 26 to 29/11/2013

TESTS LOCATION: Open area test site in Aunainville (28) - FRANCE

TESTS OPERATOR: F. LHEUREUX

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1. INTRODUCTION

This document presents the results of Electromagnetic Compatibility tests performed on the equipment «Wireless handheld payment terminal type: IWL257» according to reference documents listed below.

2. REFERENCE DOCUMENTS

FCC Part 15: 2013

Code of Federal Regulations
Title 47- Telecommunication
Chapter 1- Federal Communication Commission
Part 15- 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.

RSS-210 Issue 8: 2010

Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS-Gen Issue 3: 2010

General Requirements and Information for the Certification of Radio Apparatus

KDB 558074 D01 DTS Meas Guidance V03r01

Guidance for performing compliance measurement on Digital Transmission Systems (DTS) operating under § 15.247

3. PRODUCT DESCRIPTION

Class: B (residential environment)

Utilization: Wireless command for push button, sensor, beacon light

Antenna type and gain: internal PCB antenna: 2 dBi

Operating frequency range: from 2405 MHz to 2470 MHz

Number of channels: 11 for 802.11 b, 802.11 g and 802.11 n (20 MHz)
3 for 802.11 n (40 MHz)

Channel spacing: 5 MHz

Modulation: CCK, OFDM and MCS

Power source: 3.6 Vdc

Software power setting: RTTT (The power is not adjustable, only the channels and a mode)

Modification of the equipment during the tests: No.

4. TESTS AND CONCLUSION

The following table summarizes test results of the EUT.

Subpart B of the standard FCC part 15 – Unintentional radiators

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.107	Measurement of conducted emission on AC mains ports			X		
15.109	Radiated emission limits	X				

Subpart C of the standard FCC part 15 – Intentional radiators

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.205	Restricted bands of operation	X				
15.207	Measurement of conducted emission on AC mains ports			X		
15.209	Radiated emission limits; general requirements	X				
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				
	(c) 20 dB bandwidth and band-edge compliance			X		
15.247	Intentional radiated emissions					
	a) frequency hopping and digitally modulated					
	a) (1) hopping mode			X		
	a) (1) (i) frequency hopping in the band 902-928 MHz			X		
	a) (1) (ii) frequency hopping in the band 5725-5850 MHz			X		
	a) (1) (iii) frequency hopping in the band 2400-2483.5 MHz			X		
	a) (2) systems using digital modulation in the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz (6 dB bandwidth)	X				
	b) maximum peak conducted					
	b) (1) frequency hopping in the bands 2400-2483.5 MHz or 5725-5850 MHz			X		
	b) (2) frequency hopping in the band 902-928 MHz			X		
	b) (3) systems using digital modulation in the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz	X				
	b) (4) maximum peak conducted > 6 dBi					

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
	b) (4) (i) frequency hopping in the band 2400–2483.5 MHz			X		
	b) (4) (ii) frequency hopping in the band 5725–5850 MHz			X		
	b) (4) (iii) fixed, point-to-point			X		
	c) directional antenna > 6 dBi					
	c) (1) fixed, point-to-point operation					
	c) (1) (i) in the band 2400–2483.5 MHz			X		
	c) (1) (ii) in the band 5725–5850 MHz			X		
	c) (1) (iii) fixed, point-to-point			X		
	c) (2) multiple directional beams in the band 2400–2483.5 MHz					
	c) (2) (i) information			X		
	c) (2) (ii) sum of the power supplied to all antennas			X		
	c) (2) (iii) one antenna for multiple directional beams			X		
	c) (2) (iv) single directional beam			X		
	d) intentional radiator			X		
	e) peak power spectral density	X				
	f) hybrid system			X		
	g) continuous data stream during the test					
	h) to avoid hopping on occupied channels					
	i) RF exposure compliance			X		P < 500 mW

N.A.: Not Applicable

N.P.: Not Performed

Standard RSS-210 Issue 8 : 2010

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
1. Scope					
2. General Certification Requirements and Specifications					
2.1 RSS-gen compliance			X		See RSS-Gen
2.2 Emissions Falling Within Restricted Frequency Bands			X		See RSS-Gen
2.3 Receivers			X		See RSS-Gen
2.4 Cordless Telephones (General Conditions)			X		See CS-03
2.5 General Field Strength Limits			X		See RSS-Gen
Annex 8 – Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928, 2400-2483.5 and 5725-5850 MHz					
A8.1 Frequency Hopping Systems					
a) -20 dB emission bandwidth and system RF bandwidth			X		
b) channel carrier frequencies separation			X		
c) 902-928 MHz frequency hopping systems			X		
d) 2400-2483.5 MHz frequency hopping systems			X		
e) 5725-5850 MHz frequency hopping systems			X		
A8.2 Digital Modulation Systems					
a) -6 dB bandwidth	X				
b) transmitter power spectral density	X				
A8.3 Hybrid systems			X		
A8.4 Transmitter Output Power and e.i.r.p. Requirements					
1) 902-928 MHz frequency hopping systems output power / e.i.r.p.			X		
2) 2400-2483.5 MHz frequency hopping systems output power / e.i.r.p.			X		
3) 5725-5850 MHz frequency hopping systems output power / e.i.r.p.			X		
4) Digital modulation systems output power / e.i.r.p.	X				
5) point-to-point systems (2400-2483.5 and 5725-5850 MHz)			X		
6) Multiple directional beams antenna systems (2400-2483.5 MHz)			X		
A8.5 Out-of-band Emissions	X				

Standard RSS-Gen Issue 3 : 2010

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
1. Scope					
2. General Information					
2.1 Categories of radio Equipment	X				Category I II radio Equipment
2.2 Receivers	X				Category I II Receiver
2.3 Licence-exempt Radio Apparatus			X		See §7
2.4 Licensing of Radio Apparatus			X		
3. Equipment Certification of Radio Apparatus					
3.1 Application for equipment Certification					See RSP-100
3.2 Modular Approval			X		Note 1
3.3 Connection with the Public Switched Network			X		See CS-03 The device must be registered in accordance with DC-01.
4. Measurement Methods					
4.1 Methods, Instrumentation and Facilities for the Measurement of RF Signals and Noise Emitted from Radio Apparatus					See ANSI C63.4
4.2 Open Area Test Site and Alternative Site Registration					Emitech OATS registration number: 4379A/B/C
4.3 Compliance Testing and Reporting			X		
4.4 CISPR Quasi-peak Detector	X				
4.5 Pulsed Operation			X		
4.6 Bandwidth	X				6 dB
4.7 Transmitter Frequency Stability			X		See §7
4.8 Transmitter output Power	X				See §7
4.9 Transmitter Unwanted Emissions	X				See §7 ; Note 2
4.10 Receiver Spurious Emissions	X				See §6 ; Note 3
4.11 Near-field Measurement Method Below 30 MHz			X		
5. General Requirements					
5.1 Quality Control and Post-certification Investigation/Audits			X		Note 4
5.2 Equipment Certification Numbers and Labels			X		Note 5
5.3 required Notices to the User			X		Note 6
5.4 External Controls			X		Note 7
5.5 multiple Band Operation			X		Note 8
5.6 Exposure of Humans to RF Fields			X		See RSS-102
5.7 Radiocommunication Antenna Systems			X		See CPC-2-0-03
6. Receiver Spurious Emission Limits					
6.1 Radiated Limits	X				
6.2 Antenna Conducted Limits			X		

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
7. Licence-exempt Radio Apparatus					
7.1 General Informations					
7.1.1 External Amplifiers			X		
7.1.2 Transmitter Antenna			X		
7.1.3 User manual Notice					<i>User manual shall include the required statements</i>
7.1.4 Radio Apparatus Containing Digital Circuits			X		<i>See ICES-003</i>
7.1.5 Measurement After Installation			X		
7.1.6 operating Frequency range of Devices in Master/Slave Networks			X		
7.1.7 Home-built Devices			X		
7.1.8 RFID Devices			X		
7.2 Measurement Methods and Standard Specifications					
7.2.1 Measurement Bandwidths and Detector Functions			X		
7.2.2 Emissions Falling Within Restricted Frequency Bands	X				
7.2.3 Devices Employing Pulsed Operation			X		
7.2.4 AC Power Line Conducted Emissions Limits			X		
7.2.5 Transmitter Spurious Emission Limits	X				
7.2.6 Transmitter Frequency Stability			X		
7.2.7 Measurement Distance			X		

Note 1: Single / Split / limited modular transmitter.

The host devices of the certified module(s) shall be properly labeled to identify the module(s) within.

Note 2: Spectrum investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower (F<10 GHz) or to the 5th harmonic of the highest fundamental frequency or 100 GHz, whichever is lower (F≥10 GHz).

Note 3: Spectrum investigated from the lowest frequency internally generated or used in the receiver or 30 MHz, whichever is higher to at least 3 times the highest tuneable or local oscillator frequency, whichever is higher without exceeding 40 GHz.

Note 4: The certificate holder shall be able to demonstrate a quality control process used for production. Inspection and testing in accordance with good engineering practices.

Note 5: The device must be properly identified and labeled.

Note 6: Suppliers of radio apparatus shall provide notices and user information in both English and French.

Note 7: The device shall not have any external controls accessible to the user.

Note 8: When transitioning between bands, the equipment shall not actively transmit

Conclusion:

The tested sample " Payment terminal type: IWL250 " submitted to the tests complies with the requirements of the standards:

- FCC PART 15: 2013
- RSS-210 Issue 8 : 2010
- RSS-Gen Issue 3 : 2010

According to the limits specified in this report.

5. DIGITAL MODULATION SYSTEMS

Standards: FCC PART 15 : 2013
RSS-210 Issue 8 : 2010

Sections: 15.247 a) (2)
Annex A8.2 a) of RSS-210

Test configuration:

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.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	AM 4.0-O	7625
Cable	Micro-Coax	N-13m	8063
Open area test site	Emitech	Aunainville	187
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175
Turntable	Maturo	MCU	7626

Equipment under test operating condition:

EUT is in continuous transmission mode with RTTT software.

Measure conditions:

Ambient temperature (°C): 15

Relative humidity (%): 75

Resolution bandwidth: 100 kHz

Results:

Power source: 3.6 Vd.c

Channel	Mode	Results	Comments
1 (2412 MHz)	B	9.3 MHz	See annex n°4
7 (2442 MHz)		10.3 MHz	See annex n°4
11 (2462 MHz)		9.5 MHz	See annex n°4
1 (2412 MHz)	G	15.1 MHz	See annex n°4
7 (2442 MHz)		15.1 MHz	See annex n°4
11 (2462 MHz)		15.4 MHz	See annex n°4
1 (2412 MHz)	N (20 MHz)	15.2 MHz	See annex n°4
7 (2442 MHz)		15.2 MHz	See annex n°4
11 (2462 MHz)		15.1 MHz	See annex n°4
3 (2427 MHz)	N (40 MHz)	30.1 MHz	See annex n°4
9 (2457 MHz)		35.1 MHz	See annex n°4

Test conclusion: Complies with the requirements of the standard.

6. TRANSMITTER OUTPUT POWER

Standards: FCC PART 15 : 2013
RSS-Gen Issue 3 : 2010

Sections: 15.247 b) (3)
4.8 of RSS Gen

Test configuration:

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.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	AM 4.0-O	7625
Cable	Micro-Coax	N-13m	8063
Open area test site	Emitech	Aunainville	187
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175
Turntable	Maturo	MCU	7626

Equipment under test operating condition:

EUT is in continuous transmission mode with RTTT software.

Measure conditions:

Ambient temperature (°C): 15

Relative humidity (%): 75

Resolution bandwidth: 1 MHz

Results:

Power source: 3.6 Vd.c

Channel	Mode	Electro-magnetic field (dBµV/m)	TP* (mW)
1 (2412 MHz)	B	108.3	12.837
7 (2442 MHz)		107.2	9.965
11 (2462 MHz)		107.7	11.181
1 (2412 MHz)	G	107.2	9.965
7 (2442 MHz)		104.2	4.994
11 (2462 MHz)		103.4	4.154
1 (2412 MHz)	N (20 MHz)	108.4	13.136
7 (2442 MHz)		105.3	6.434
11 (2462 MHz)		106.0	7.559
3 (2427 MHz)	N (40 MHz)	100.0	1.899
9 (2457 MHz)		98.1	1.226

* TP = $(FS \times d)^2 / (30 \times G)$ with $d = 3$ m, $G = 1.58$ and $FS = V/m$

Test conclusion: Complies with the requirements of the standards.

7. PEAK POWER SPECTRAL DENSITY

Standards: FCC PART 15 : 2013
RSS-210 Issue 8 : 2010

Sections: 15.247 e)
Annex A8.2 b) of RSS-210

Test configuration:

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.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	AM 4.0-O	7625
Cable	Micro-Coax	N-13m	8063
Open area test site	Emitech	Aunainville	187
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175
Turntable	Maturo	MCU	7626

Equipment under test operating condition:

EUT is in continuous transmission mode with RTTT software.

Measure conditions:

Ambient temperature (°C): 15
 Relative humidity (%): 75

Resolution bandwidth: 3 kHz
 Video bandwidth: 3 kHz
 Span: 1.5 MHz

Results:

Power source: 3.6 Vd.c

Channel	Mode	Electro-magnetic field (dBµV/m)	PPSD* (dBm)	Limit (dBm)
1 (2412 MHz)	B	87.0	- 10.2	+ 8.0
7 (2442 MHz)		85.4	- 11.8	
11 (2462 MHz)		86.0	- 11.2	
1 (2412 MHz)	G	78.4	- 18.8	
7 (2442 MHz)		76.2	- 21.0	
11 (2462 MHz)		74.8	- 22.4	
1 (2412 MHz)	N (20 MHz)	82.5	- 14.7	
7 (2442 MHz)		79.2	- 18.0	
11 (2462 MHz)		78.6	- 18.6	
3 (2427 MHz)	N (40 MHz)	72.5	- 24.7	
9 (2457 MHz)		70.7	- 26.5	

* PPSD = (FS×d)² / (30×G) with d = 3 m, G = 1.58 and FS = V/m

Test conclusion: Complies with the requirements of the standards.

8. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSIONS LIMITATION

Standard: FCC PART 15 : 2013

Section: 15.215 (b)

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	AM 4.0-O	7625
Cable	Micro-Coax	N-13m	8063
Open area test site	Emitech	Aunainville	187
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175
Turntable	Maturo	MCU	7626

Equipment under test arrangement:

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.

Results:

Ambient temperature (°C): 15

Relative humidity (%): 75

Lower Band Edge: from 2310 MHz to 2390 MHz

Upper Band Edge: from 2483.5 MHz to 2500 MHz

- Mode b

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)	Limits (dBμV/m)	Margin (dB)
2412.80	101.3	Peak	2366.96	- 51.6	49.7	54.0	4.3
2462.10	101.7	Peak	2488.90	- 51.6	50.1	54.0	3.9

* according to step 2 of Marker-Delta Method DA 00-705.

Band-edge curves are given in annex 5.

- Mode g

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) *	Calculated Max Out of Band Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
2410.88	97.7	Peak	2311.52	- 48.1	49.6	54.0	4.4
2460.70	94.7	Peak	2489.10	- 45.0	49.7	54.0	4.3

* according to step 2 of Marker-Delta Method DA 00-705.

Band-edge curves are given in annex 5.

- Mode n (20 MHz)

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) *	Calculated Max Out of Band Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
2410.88	99.2	Peak	2375.88	- 50.3	48.9	54.0	5.1
2460.70	95.8	Peak	2491.10	- 45.9	49.9	54.0	4.1

* according to step 2 of Marker-Delta Method DA 00-705.

Band-edge curves are given in annex 5.

- Mode n (40 MHz)

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) *	Calculated Max Out of Band Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
2427.07	91.6	Peak	2360.80	- 42.2	48.8	54.0	5.2
2456.90	89.9	Peak	2484.33	- 38.8	51.1	54.0	2.9

* according to step 2 of Marker-Delta Method DA 00-705.

Band-edge curves are given in annex 5.

9. UNINTENTIONAL RADIATED EMISSIONS AND TRANSMITTER UNWANTED EMISSION IN THE BAND 9 KHz – 25 GHz

Standards: FCC PART 15 : 2013
RSS-Gen Issue 3 : 2010

Sections: 15.205; 15.209 and 15.247
4.9 of RSS-Gen

Equipment under test arrangement:

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the table on the next pages.

The E.U.T. is blocked in continuous transmission.

Frequency range: 9 kHz – 30 MHz
30 MHz - 1 GHz
1 GHz – 25 GHz

Detection mode: Quasi-peak for 9 kHz – 30 MHz
Quasi-peak for 30 MHz - 1 GHz
Average for 1 GHz – 25 GHz

Resolution bandwidth: 200 Hz for 9 kHz – 150 kHz
9 kHz for 150 kHz – 30 MHz
120 kHz for 30 MHz - 1 GHz
1 MHz for 1 GHz – 25 GHz

Measurement distance: 30 meters from 9 kHz to 30 MHz
3 meters from 30 MHz to 25 GHz

- Limit for emission radiated outside the frequency band, except the harmonics, shall be attenuated by at least 20 dB below the level of fundamental or the general radiated emission limits.

From 9 kHz to 30 MHz

Frequency range	Limit $\mu\text{V/m}$
9 – 490 kHz	$2400/F$ (F in kHz) *
490 – 1705 kHz	$24000/F$ (F in kHz)
1.705 – 30 MHz	30

* Limits in $\mu\text{V/m}$ can be extrapolated to 30 m using 20 dB / decade.

From 30 MHz to 25 GHz

Frequency range (MHz)	Limit	
	(dB $\mu\text{V/m}$)	$\mu\text{V/m}$
30 to 88	40.0	100
88 to 216	43.5	150
216 to 960	46.0	200
Above 960	54.0	500

- Limit for field strength of harmonic: 54 dB $\mu\text{V/m}$ (500 $\mu\text{V/m}$)

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Schwarzbeck	Biconique VHA9103	317
Antenna	Oritel	Cornet CM 42-25	1045
Antenna	Schwarzbeck	Log-périodique UHALP 9108	3106
Antenna	Emco	Cornet 3115	3374
Antenna	EMCO	Cadre Emco 6502	9579
Antenna mast	Maturo	AM 4.0-O	7625
Antenna mast	Maturo	MCU	7626
Cable	Câbles & Connectiques	N-13m	2452
Cable	-	N-2m	2805
Cable	Câbles & Connectiques	N-SMA	2864
Cable	-	N-30m	4359
Cable	-	N-8m	8021
Cable	Micro-Coax	N-13m	8063
Filter	Trilithic	Passe haut	1097
Filter	Micro-tronics	Passe haut	4691
Filtet	Trilithic	Passe haut	1529
Open area test site	Emitech	Aunainville	187
Preamplifier	Mini-Circuits	RF	48
Preamplifier	MITEQ	HF	3229
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175

Results:
Mode b: Channel 1, 7, 11

No significant frequency has been found other than those given above between 9 kHz and 25 GHz.

Mode g: Channel 1, 7, 11

No significant frequency has been found other than those given above between 9 kHz and 25 GHz.

Mode n (20 MHz): Channel 1, 7, 11

No significant frequency has been found other than those given above between 9 kHz and 25 GHz.

Mode n (40 MHz): Channel 1, 7, 11

No significant frequency has been found other than those given above between 9 kHz and 25 GHz.

Test conclusion:

The equipment complies with the requirements of the standards FCC and RSS-Gen.

10. RECEIVER SPURIOUS EMISSIONS

Standard: RSS-Gen Issue 3 : 2010

Section: 4.10 of RSS-Gen

Equipment under test arrangement:

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the table on the next pages.

The E.U.T. is blocked in standby / reception mode.

Frequency range: 30 MHz - 1 GHz
1 GHz – 25 GHz

Detection mode: Quasi-peak for 30 MHz - 1 GHz
Average for 1 GHz – 25 GHz

Resolution bandwidth: 120 kHz for 30 MHz - 1 GHz
1 MHz for 1 GHz – 25 GHz

Measurement distance: 3 meters from 30 MHz to 25 GHz

- Limit for emission radiated outside the frequency band, except the harmonics, shall be attenuated by at least 20 dB below the level of fundamental or the general radiated emission limits in § 15.247 (see table).

Frequency range (MHz)	Limit	
	(dB μ V/m)	μ V/m
30 to 88	40.0	100
88 to 216	43.5	150
216 to 960	46.0	200
Above 960	54.0	500

- Limit for field strength of harmonic: 54 dB μ V/m (500 μ V/m)

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Schwarzbeck	Biconique VHA9103	317
Antenna	Oritel	Cornet CM 42-25	1045
Antenna	Schwarzbeck	Log-périodique UHALP 9108	3106
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	AM 4.0-O	7625
Antenna mast	Maturo	MCU	7626
Cable	Câbles & Connectiques	N-13m	2452
Cable	-	N-2m	2805
Cable	Câbles & Connectiques	N-SMA	2864
Cable	Micro-Coax	N-13m	8063
Filter	Trilithic	Passe haut	1097
Filter	Micro-tronics	Passe haut	4691
Filtet	Trilithic	Passe haut	1529
Open area test site	Emitech	Aunainville	187
Preamplifier	Mini-Circuits	RF	48
Preamplifier	MITEQ	HF	3229
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175

Results:

Mode b: Channel 1, 7, 11

No frequencies are observed between 30 MHz to 25 GHz for both polarizations.

Mode g: Channel 1, 7, 11

No frequencies are observed between 30 MHz to 25 GHz for both polarizations.

Mode n (20 MHz): Channel 1, 7, 11

No frequencies are observed between 30 MHz to 25 GHz for both polarizations.

Mode n (40 MHz): Channel 1, 7, 11

No frequencies are observed between 30 MHz to 25 GHz for both polarizations.

Test conclusion:

The equipment complies with the requirements of the standard RSS-Gen.

11. RADIATED EMISSION LIMIT

Standard: FCC PART 15 : 2013

Section: 15.109

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Schwarzbeck	Biconique VHA9103	317
Antenna	Schwarzbeck	Log-périodique UHALP 9108	3106
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	AM 4.0-O	7625
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Cable	Micro-Coax	N-13m	8063
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Filter	Micro-tronics	Passe haut	4691
Open area test site	Emitech	Aunainville	187
Preamplifier	Mini-Circuits	RF	48
Preamplifier	MITEQ	HF	3229
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175

Equipment under test arrangement:

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 30 MHz to harmonic 5 (highest frequency used = 2400 MHz).

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

Detection mode: Quasi-peak (F < 1 GHz)
Average (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.

Operating mode during the test:

The E.U.T. is blocked in continuous transmission mode.

Results:

No frequencies are observed between 30 MHz to 13 GHz for both polarizations.

Test conclusion: Standard respected

« □□□ End of report, 6 annexes to be forwarded □□□ »

ANNEX 1

Antenna factors, insertion losses and amplifier values

BILL OF MATERIAL

The test antenna used for the radiated emission between 9 kHz and 30 MHz is the active loop antenna n°9579. Antenna factors are given in table 1.

The test antenna used for the radiated emission between 30 MHz and 200 MHz is the biconical antenna n°317. Antenna factors are given in table 2.

The test antenna used for the radiated emission between 200 MHz and 1 GHz is the log-periodic antenna n°3106. Antenna factors are given in table 3.

The measuring receiver n°1216 used in the frequency range 30 MHz to 1 GHz has an integrated preamplifier.

The spectrum analyzer n°5175 is used in the frequency range 1 GHz to 25 GHz.

The test cable used between 9 kHz and 30 MHz to connect the antennas to the receiver for measurements at a distance of 30 meters has losses given in table 4.

The test cable used between 30 MHz and 1 GHz to connect the antennas to the receiver for measurements at a distance of 3 meters has losses given in table 5.

The test antenna used for the radiated emission between 1 GHz and 18 GHz is the horn antenna n°3374. Factors are given in table 6.

The test antenna used for the radiated emission between 18 GHz and 25 GHz is the horn antenna n°1045. Factors are given in table 7.

The amplifier n°3229 used to connect the spectrum analyzer to the test cable has gain values given in the table 8.

The test cable used between 1 GHz and 26 GHz to connect the horn antenna to the amplifier for measurements at a distance of 3 meters has losses given in table 9.

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
0.009	- 21.8	0.8	- 35.2
0.01	- 22.7	1	- 35.2
0.015	- 25.7	1.5	- 35.3
0.02	- 28.4	2	- 35.4
0.03	- 31.2	3	- 35.4
0.05	- 33.6	5	- 35.4
0.08	- 34.7	8	- 35.4
0.1	- 35.0	10	- 35.4
0.15	- 35.4	15	- 35.4
0.2	- 35.5	20	- 35.7
0.3	- 35.5	25	- 36.1
0.5	- 35.4	30	- 36.9

TABLE 1 : ACTIVE LOOP ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
30	18.9	90	8.5
35	17.1	100	10.1
40	15.1	120	13.0
45	13.3	140	14.5
50	11.5	160	15.5
60	8.0	180	15.7
70	6.4	200	16.1
80	6.9	-	-

TABLE 2 : BICONICAL ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
200	24.0	700	20.6
300	14.5	800	21.1
400	16.8	900	22.2
500	17.9	1000	23.2
600	19.5	-	-

TABLE 3 : LOG-PERIODIC ANTENNA

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
0.009	0.0	6.000	0.5
0.020	0.0	7.000	0.5
0.050	0.0	8.000	0.5
0.100	0.0	9.000	0.6
0.500	0.1	10.00	0.6
1.000	0.2	15.00	0.7
2.000	0.2	20.00	0.8
3.000	0.3	25.00	1.0
4.000	0.4	30.00	1.1
5.000	0.4	-	-

TABLE 4 : TEST CABLE FOR 30M MEASUREMENT INTO 9 kHz AND 30 MHz

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.7	250	1.8
40	0.7	300	2.1
50	0.9	400	2.3
60	0.9	500	2.5
70	0.9	600	3.0
80	0.9	700	3.4
90	1.1	800	3.6
100	1.1	900	3.9
150	1.4	1000	4.1
200	1.6	-	-

TABLE 5 : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz AND 1 GHz

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
1.0	23.7	10.0	37.6
1.5	24.6	10.5	37.8
2.0	27.5	11.0	38.1
2.5	28.8	11.5	38.3
3.0	29.8	12.0	38.8
3.5	31.2	12.5	38.8
4.0	32.5	13.0	39.4
4.5	32.5	13.5	40.0
5.0	33.5	14.0	40.1
5.5	34.1	14.5	40.6
6.0	34.1	15.0	40.6
6.5	34.4	15.5	39.7
7.0	35.4	16.0	39.3
7.5	36.6	16.5	39.9
8.0	36.6	17.0	41.4
8.5	37.0	17.5	45.1
9.0	37.1	18.0	46.3
9.5	37.2		

TABLE 6 : HORN ANTENNA

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
18.0	31.5	22.5	32.7
18.5	31.8	23.0	33.2
19.0	31.9	23.5	33.1
19.5	32.1	24.0	33.2
20.0	32.2	24.5	33.3
20.5	32.4	25.0	33.3
21.0	32.5	25.5	33.2
21.5	32.4	26.0	33.1
22.0	32.4	-	-

TABLE 7 : HORN ANTENNA

Frequency (GHz)	Gain value (dB)	Frequency (GHz)	Gain value (dB)
1.0	34.9	13.0	32.3
1.5	34.8	14.0	32.1
2.0	35.1	15.0	33.0
2.5	35.1	16.0	33.5
3.0	35.3	17.0	33.5
4.0	35.7	18.0	33.7
5.0	36.0	19.0	33.7
6.0	36.2	20.0	32.5
7.0	35.5	21.0	33.0
8.0	34.8	22.0	33.0
9.0	33.2	23.0	33.0
9.5	31.9	24.0	34.3
10.0	31.3	25.0	33.2
10.5	31.1	26.0	32.0
11.0	30.9		
12.0	31.9		

TABLE 8 : AMPLIFIER GAIN VALUE

Frequency (GHz)	Loss (dB)	Frequency (GHz)	Loss (dB)
1.0	3.4	12.0	10.9
1.5	4.2	13.0	11.5
2.0	4.8	14.0	12.2
2.5	5.3	15.0	12.4
3.0	6.1	16.0	12.9
3.5	6.6	17.0	13.3
4.5	7.5	18.0	13.6
5	8.2	19.0	14.3
6	9.1	20.0	14.7
8	9.9	22.0	15.6
10	11.6	24.0	16.6
11.0	10.4	26.0	17.0

TABLE 9: TEST CABLE FOR 3M MEASUREMENT INTO 1 TO 26 GHz

ANNEX 2

External photographs





ANNEX 3

Test setup photographs





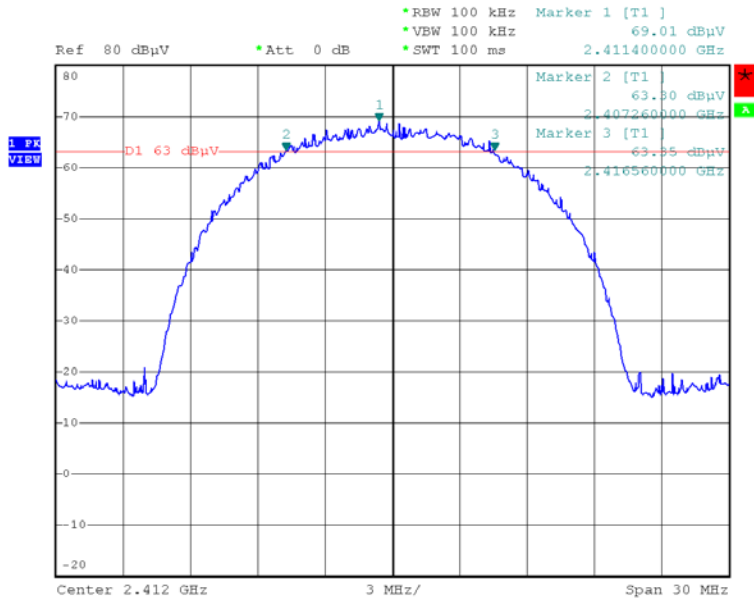


ANNEX 4

6 dB bandwidth

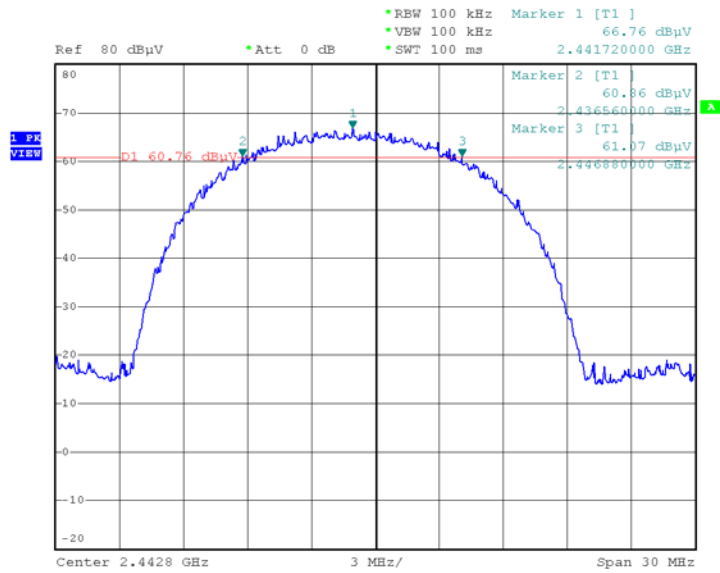
MODE B

Channel 1



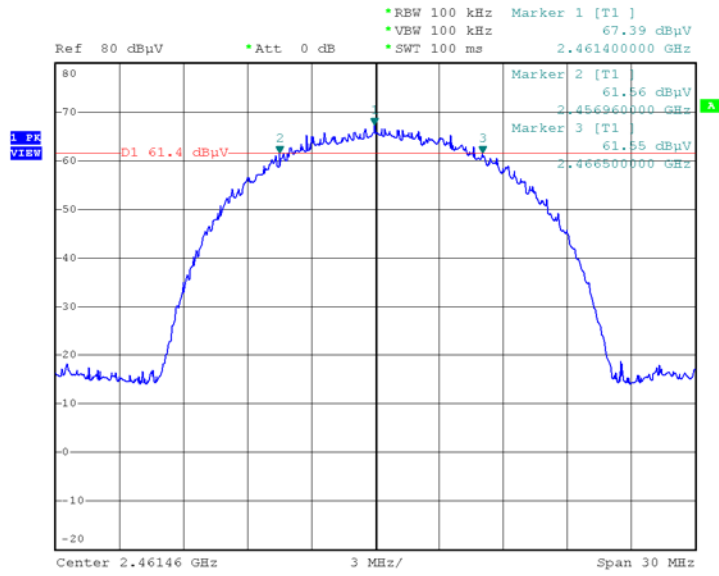
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Channel 7



Date: 26.NOV.2013 11:09:05

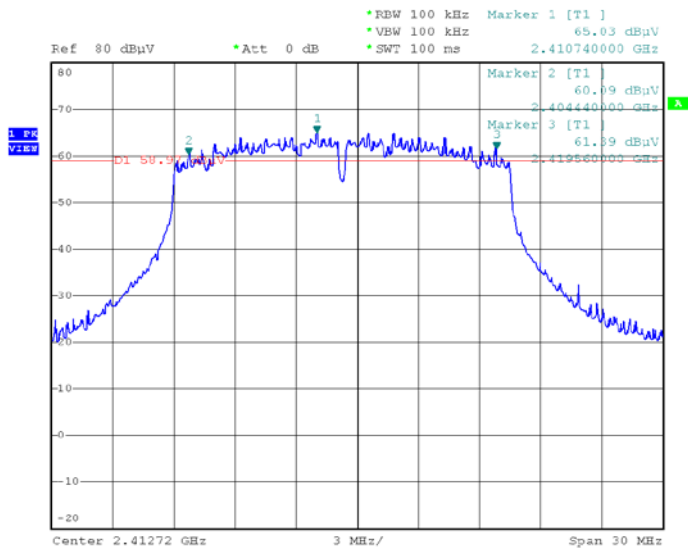
Channel 11



Date: 26.NOV.2013 11:30:23

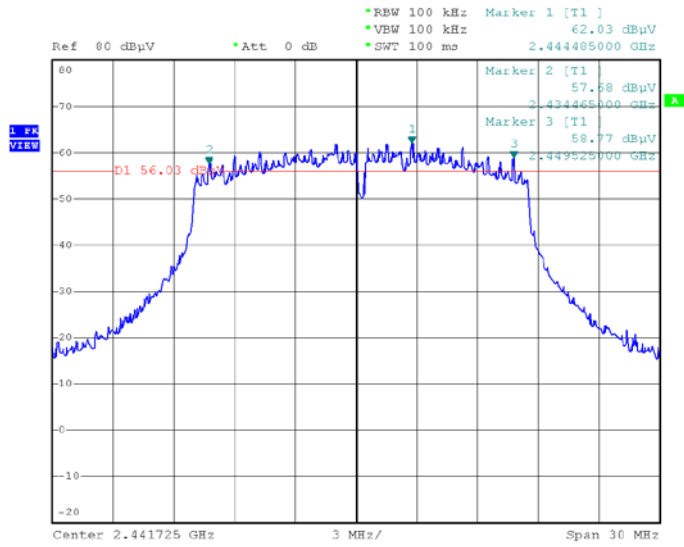
MODE G

Channel 1



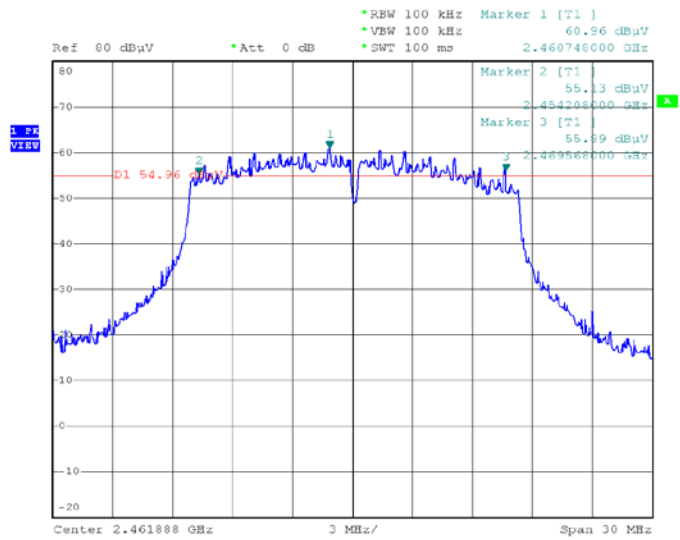
Date: 26.NOV.2013 11:52:28

Channel 7



Date: 26.NOV.2013 13:02:54

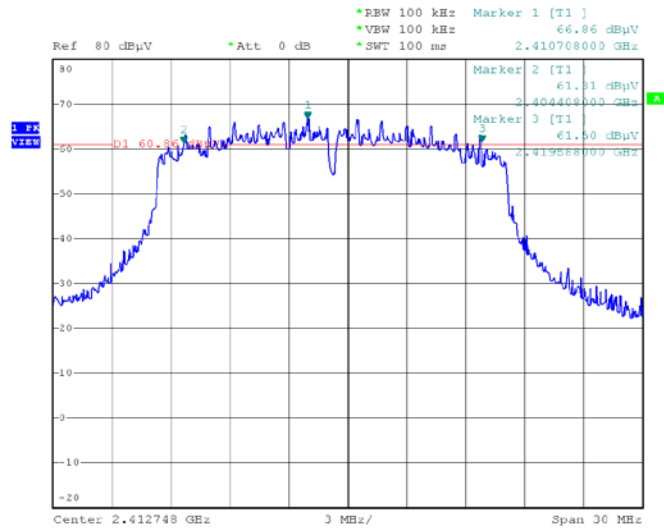
Channel 11



Date: 26.NOV.2013 13:24:30

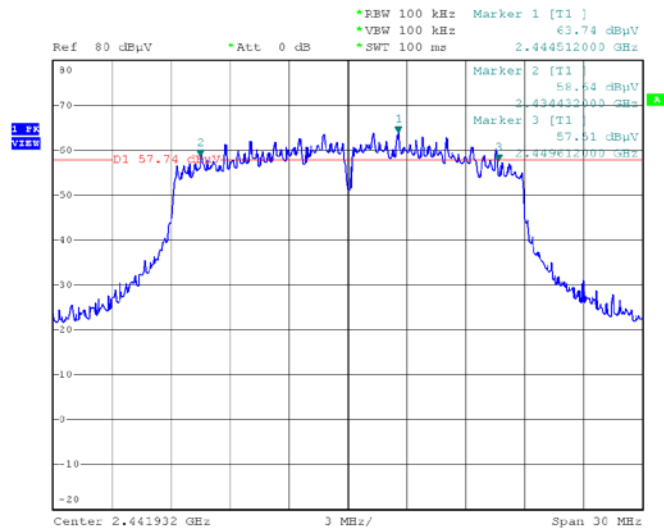
MODE N (20 MHz)

Channel 1



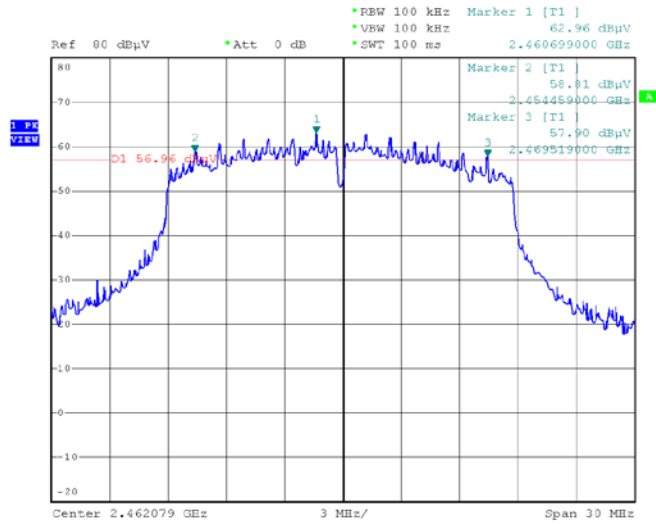
Date: 26.NOV.2013 13:46:56

Channel 7



Date: 26.NOV.2013 14:08:17

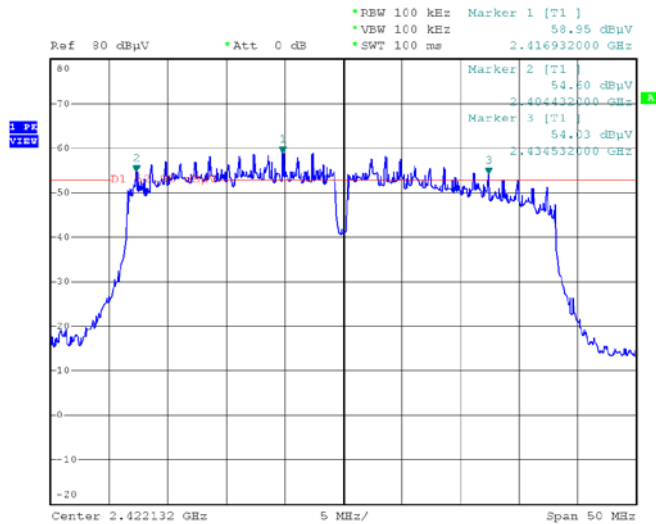
Channel 11



Date: 26.NOV.2013 14:28:35

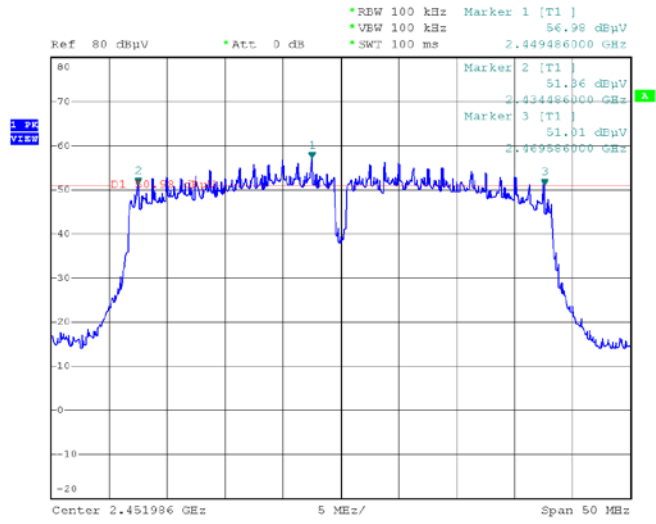
MODE N (40 MHz)

Channel 1



Date: 26.NOV.2013 14:49:55

Channel 7

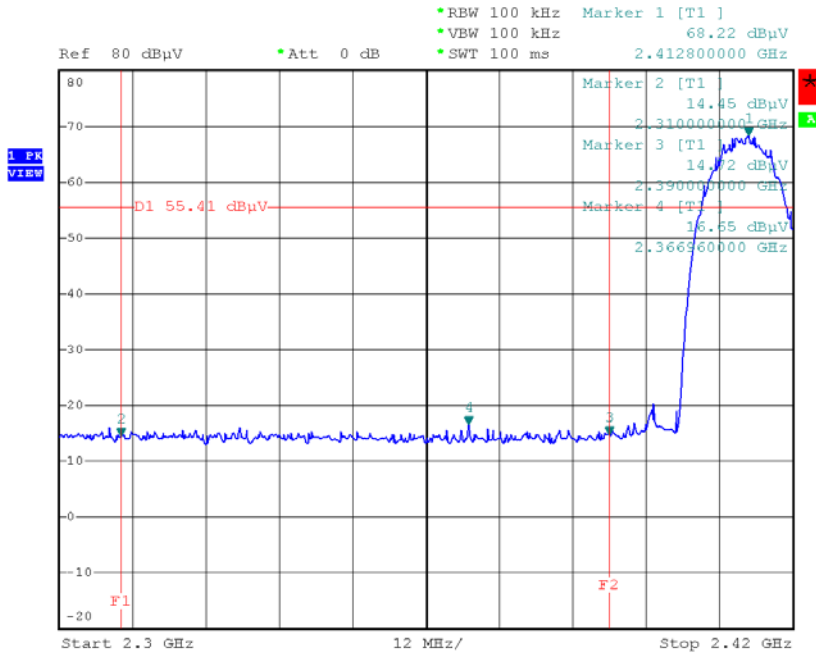


Date: 26.NOV.2013 15:18:17

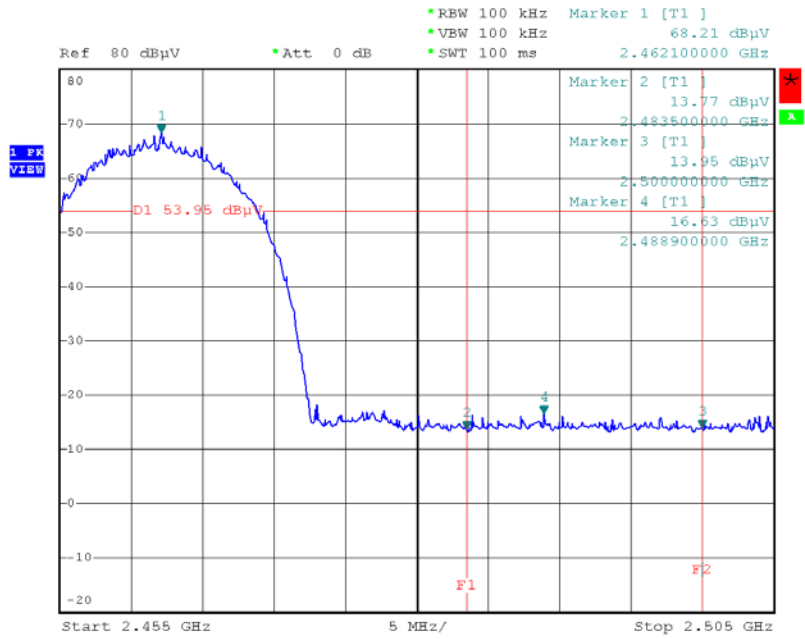
ANNEX 5

Band Edge

MODE B

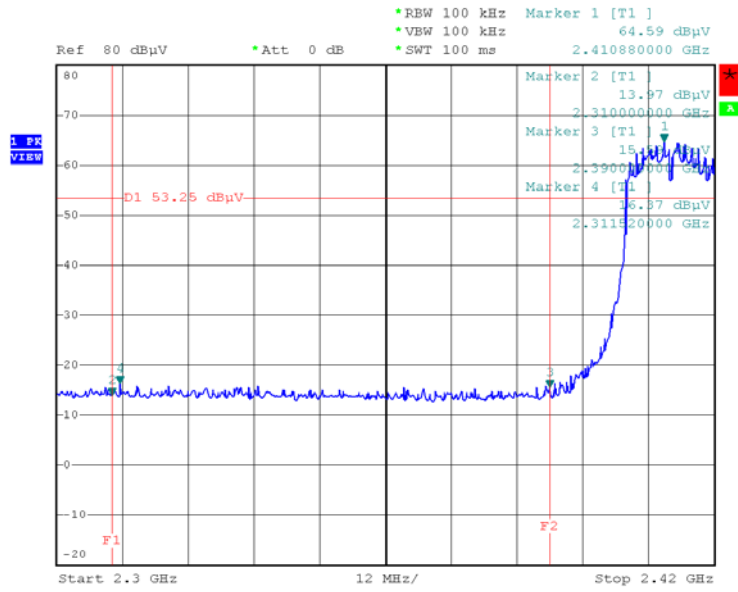


Date: 27.NOV.2013 10:01:27

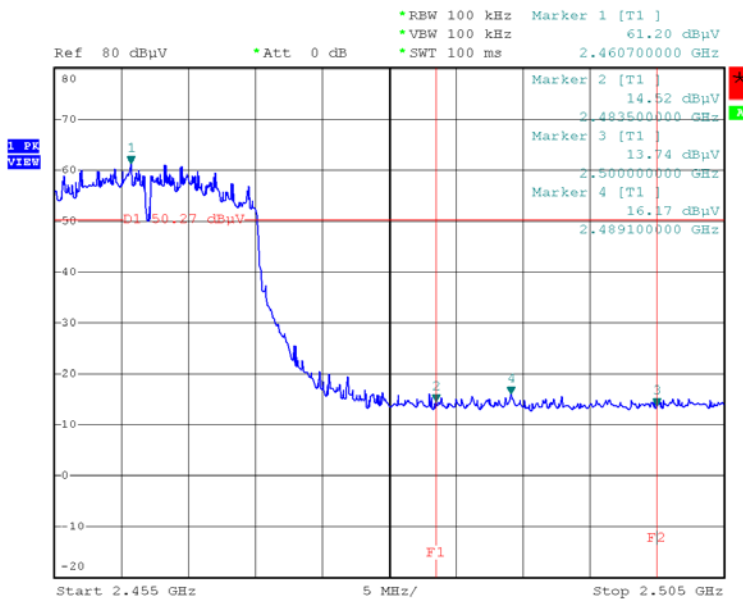


Date: 27.NOV.2013 10:08:41

MODE G

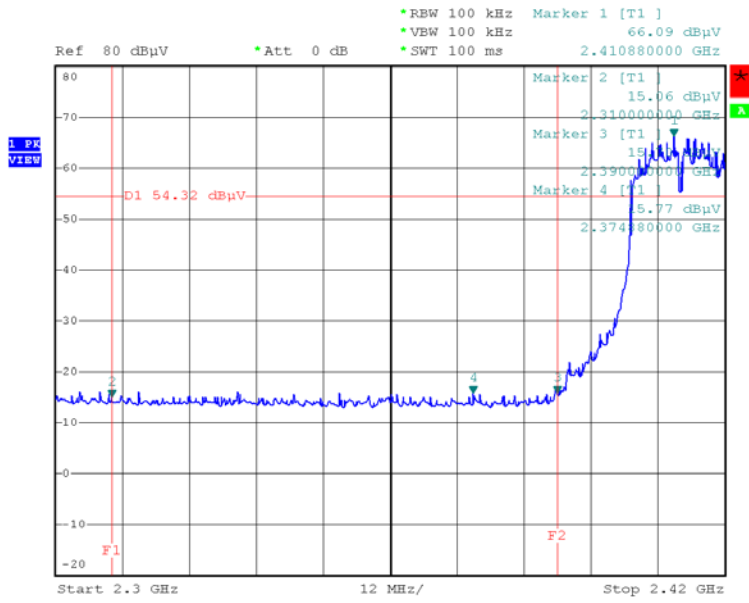


Date: 27.NOV.2013 09:57:39

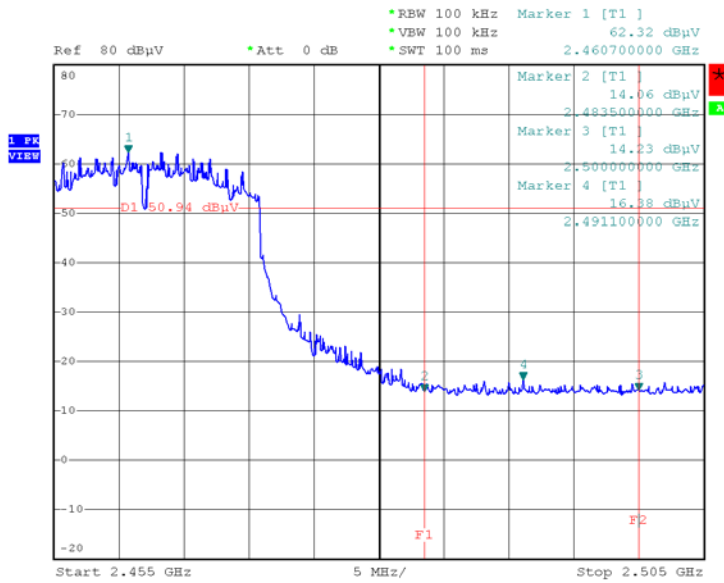


Date: 27.NOV.2013 10:13:28

MODE N (20 MHz)

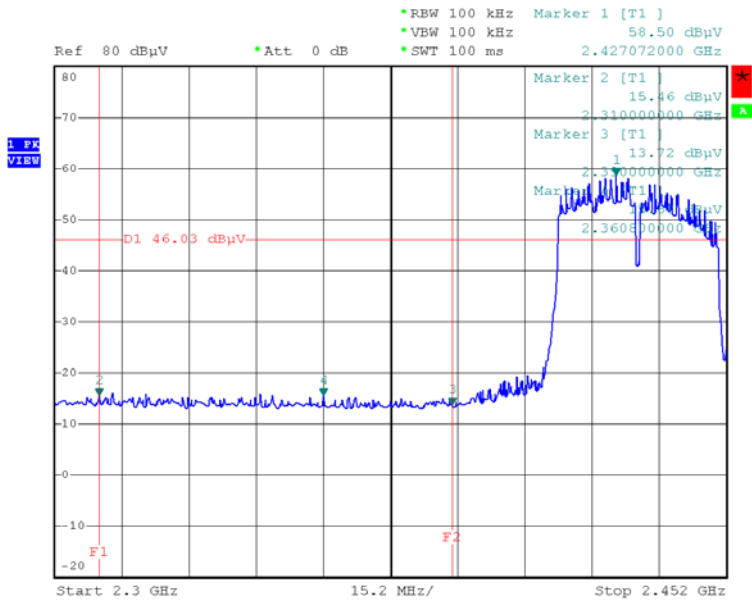


Date: 27.NOV.2013 09:52:54

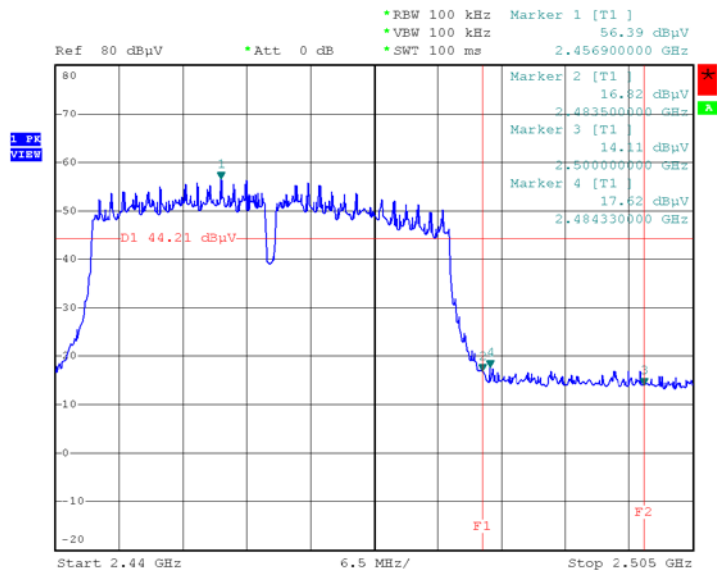


Date: 27.NOV.2013 10:18:14

MODE N (40 MHz)



Date: 27.NOV.2013 13:26:38



Date: 27.NOV.2013 13:50:15

ANNEX 6

Calibration dates

N° EMITECH	LAST CALIBRATION	CALIBRATION DUE DATE
1216	12/12/2011	12/12/2013
0187	15/03/2013	15/03/2016
3106	27/04/2012	27/04/2014
2452	24/10/2012	24/10/2014
2805	01/08/2013	01/08/2015
3374	08/02/2012	08/02/2016
2864	14/12/2011	14/12/2013
8063	06/08/2012	06/08/2014
1097	15/03/2013	15/03/2015
1529	15/03/2013	15/03/2015
4691	15/03/2013	15/03/2015
5175	27/03/2012	27/03/2014
9579	22/10/2012	22/10/2014
4359	07/03/2012	07/03/2014
0317	19/08/2010	19/08/2014
1045	13/12/2010	13/12/2014
3229	25/10/2012	25/12/2013
8021	22/02/2013	22/02/2015