

LCIE  
Etablissement de Moirans  
ZI Centr'alp  
170, rue de Chatagnon  
38430 Moirans

RCS Grenoble 408 363 174

Tél. : +33 4 76 07 36 36

Fax : +33 4 76 55 90 88



LCIE

# Rapport d'essai / Test report

N° 437359-A1-R1-E

JDE : 114994

## DELIVRE A / ISSUED TO

: INGENICO  
10 rue du golf  
33700 MERIGNAC - FRANCE

## Objet / Subject

: Essais de compatibilité électromagnétique conformément aux normes  
**FCC CFR 47 Part 15, Subpart B et C**  
**RSS-210 Issue 8**  
*Electromagnetic compatibility tests according to the standards*  
**FCC CFR 47 Part 15, Subpart B and C**  
**RSS-210 Issue 8**

## Matériel testé / Apparatus under test :

- Produit / Product : Terminal de paiement / *Payment terminal*
- Marque / Trade mark : **INGENICO**
- Constructeur / Manufacturer : **INGENICO**
- Type / Model : **IMP3X2-01T20XXA**
- Type sous test / Model under test : **IMP352-01T2005A**
- N° de série / serial number : **12110PP60030330**
- FCC ID : **XKB-IMP3X2**
- IC : **2586D-IMP3X2**

## Date des essais / Test date

: Du 20 au 26 Juillet 2012 / *From July 20<sup>th</sup> to 26<sup>th</sup>, 2012*

## Lieu d'essai / Test location

: **LCIE SUD-EST**  
ZI Centr'Alp – 170 rue de Chatagnon  
38430 MOIRANS - FRANCE

Test réalisé par / *Test performed by* : Anthony MERLIN

Ce document comporte / *Composition of document* : 57 pages.

Ecrit par / *Written by*,  
Anthony MERLIN

MOIRANS, LE 23 AOUT 2012 / *AUGUST 23RD, 2012*

Approuvé par / *Approved by*,  
Yannick SAVOIE



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LCIE

33, av du Général Leclerc  
BP 8  
92266 Fontenay-aux-Roses cedex  
France

Tél : +33 1 40 95 60 60  
Fax : +33 1 40 95 86 56  
contact@lcie.fr  
www.lcie.fr

Société par Actions Simplifiée  
au capital de 15 745 984 €  
RCS Nanterre B 408 363 174  
www.lcie.com



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**1. TEST PROGRAM**

**Standard:** - FCC Part 15, Subpart C 15.247 - ANSI C63.4 (2003)  
 - RSS-210 Issue 8 – Dec 2010 - RSS-Gen Issue 3 – Dec 2010

EMISSION Test	LIMITS			RESULTS (Comments)
	Frequency	Quasi-peak value (dBµV)	Average value (dBµV)	
Limits for conducted disturbance at mains ports 150kHz-30MHz	150-500kHz	66 to 56	56 to 46	PASS
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz CFR 47 §15.209 (a) CFR 47 §15.247 (d) and §15.225 RSS-210 §A8.5 and RSS-Gen §4.9	<b>Measure at 300m</b> 9kHz-490kHz : 67.6dBµV/m /F(kHz) <b>Measure at 30m</b> 490kHz-1.705MHz : 87.6dBµV/m /F(kHz) 1.705MHz-30MHz : 29.5 dBµV/m			PASS
Radiated emissions 30MHz-25GHz* CFR 47 §15.209 (a) CFR 47 §15.247 (d) and §15.225 RSS-210 §A8.5 and RSS-Gen §4.9	<b>Measure at 3m</b> 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m			PASS
Maximum Peak Output Power CFR 47 §15.247 (b) RSS-210 §A8.4(1)	<b>Limit: 21dBm</b> Conducted or Radiated measurement			PASS
Hopping Channel Separation CFR 47 §15.247 (a) (1) RSS-210 §A8.1(b)	<b>Minimum between:</b> Two-third 20dB Bandwidth or 25kHz Whichever is greater			PASS
Number of Hopping Frequencies CFR 47 §15.247 (a) (1) (iii) RSS-210 §A8.1(d)	<b>At least 15 channels used</b>			PASS
Time of Occupancy (Dwell Time) CFR 47 §15.247 (a) (1) (iii) RSS-210 §A8.1(d)	<b>Maximum 0.4 sec within 31.6sec</b>			PASS
Band Edge Measurement CFR 47 §15.209 (a) and CFR 47 §15.247 (d) RSS-210 §A8.5	<b>Limit: -20dBc</b>			PASS
Fundamental field strength limit CFR 47 §15.225 RSS-210 §A2.6	<b>Operation within the band</b> <b>13.110-14.010 MHz</b>			PASS
Fundamental frequency tolerance CFR 47 §15.225 RSS-210 §A2.6	<b>Operation within the band</b> <b>13.110-14.010 MHz</b>			PASS
Band edge compliance CFR 47 §15.225 RSS-210 §A2.6	<b>Operation within the band</b> <b>13.110-14.010 MHz</b>			PASS
Occupied bandwidth RSS-Gen §4.6.1	<b>No limit</b>			PASS
Receiver Spurious Emission** RSS-Gen §4.10	<b>See RSS-Gen §4.10</b>			NA

\*§15.33: The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.

- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.
- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.
- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.

If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.

\*\*Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.



## 2. SYSTEM TEST CONFIGURATION

### 2.1. JUSTIFICATION

The system was configured for testing in a typical fashion (as a customer would normally use it). All configurations of EUT is considered, worst cases are presented in this test report.

There are two different hardware versions (with or without barcode) with different activation software:

- **IMP322-01T2004A** (No barcode / With Contact less / With Bluetooth)
  - **IMP322-01T2067A** (Contactless and IAP chip not activated)
  - **IMP322-01T2091A** (Contactless not activated)
  - **IMP322-01T2092A** (IAP chip not activated)
- **IMP352-01T2005A** (With barcode / With Contact less / With Bluetooth) **Full options (EUT)**
  - **IMP352-01T2093A** (Contactless not activated)

### 2.2. HARDWARE IDENTIFICATION

- **Equipment under test (EUT):**

**IMP352-01T2005A**

Serial number: 12110PP60030330  
FCC ID: **XKB-IMP3X2**  
IC: **2586D-IMP3X2**

- **Power supply:**

- **Base with power supply adaptor:**

PHIHONG PSC12R-050, 100-240VAC / 5A / 50-60Hz, output 5VDC / 2A, Sn: 192014382.

- **Micro USB power supply adaptor:**

PHIHONG PSAC05R-050, 100-240VAC / 300mA / 50-60Hz, output 5VDC / 1A, Sn: 192011352.

- **Battery Lithium Ion 3.7VDC**

- **Internal max frequencies:**

- Clock: 400MHz
- RFID 13.56MHz
- Bluetooth: 2400-2483.5MHz

- **Input/output:**

- 2 x Power supply contacts (Base and Terminal)
- 1 x Mini USB, only used for recharge with power supply PHIHONG PSAC05R-050

- **Cables:**

- None

- **Auxiliaries equipment used during test:**

- 1 x IMP300-BCSN1476A (Base), FCCID: XKB-IMP3XXCX, Sn: 11208KT60000910

- **Functions:**

- 1 x Contact less RFID reader at 13.56MHz, disabled during the recharge, tested only in configuration n°2.
- 1 x Bluetooth at 2400-2483.5MHz, always ON.
- 1 x Barcode, disabled during the recharge, tested only in configuration n°2.
- 1 x Contact card reader, disabled during the recharge, tested only in configuration n°2.



• **Equipment information - Bluetooth:**

- Frequency band: [ 2400.0 – 2483.5 ] MHz
- Standard:  Wifi  Bluetooth  Zigbee
- Spectrum Modulation:  FHSS  DSSS
- Modulation type:  GFSK  Pi/4 DQPSK  8DPSK
- Packet type: DH1 DH3 DH5
- Transfert data rate: 1Mbps 2Mbps 3Mbps
- Number of channel: 78
- Channel separation:  5MHz  2MHz  1MHz
- Channel bandwidth:  10MHz  20MHz  1MHz
- Channel tested: Full test on 2402MHz / 2441MHz and 2480MHz
- RF mode:  TX/RX  RX  Standby
- Antenna type: Integral
- Antenna Gain: 0dBi declaration of provider
- Antenna connector:  Permanent external  Permanent internal
- None  Temporary (only for tests)
- Normal power source: Battery Lithium Ion 3.7VDC

• **Equipment information - RFID:**

- Frequency band: [ 13.553 – 13.567 ] MHz
- Standard: RFID
- Modulation type: ASK
- Number of channel: 1
- RF mode:  TX/RX  RX  Standby
- Antenna type: Integral
- Antenna Gain: 0dBi declaration of provider
- Antenna connector:  Permanent external  Permanent internal
- None  Temporary (only for tests)
- Normal power source: Battery Lithium Ion 3.7VDC



### 3. EUT CONFIGURATION

Software used on terminal to set EUT on DUT mode for Bluetooth control by CMU200 R&S.  
In loop, RFID Contact card CAM0 and Barcode are activated.

#### **Configuration n°1:**

Terminal on its base for recharge with following parameters:

- Recharge of terminal
- Bluetooth (special mode following test controlled by CMU200 R&S)
- Contact less OFF
- CAM0 (Contact card) OFF
- Barcode OFF

#### **Configuration n°2:**

Software used on terminal, followings functions are tested in loop during all tests:

- CAM0 (Contact card)
- Contact less
- Barcode
- Bluetooth (special mode following test controlled by CMU200 R&S)

#### **Configuration n°3:**

Terminal plugged to power supply PHIHONG PSAC05R-050 for recharge with following parameters:

- Recharge of terminal
- Bluetooth (special mode following test controlled by CMU200 R&S)
- Contact less OFF
- CAM0 (Contact card) OFF
- Barcode OFF

Worst case results presented in this test report.

### 4. EQUIPMENT MODIFICATIONS

None

### 5. SPECIAL ACCESSORIES

None

**6. CONDUCTED EMISSION DATA****6.1. TEST CONDITIONS**

Date of test : July 18<sup>th</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 1005 hPa  
Relative humidity : 41%  
Ambient temperature : 24°C

**6.2. SETUP FOR CONDUCTED EMISSIONS MEASUREMENT**

The product has been tested according to ANSI C63.4-(2003) and FCC Part 15 subpart B and C.

The product has been tested with 120V/60Hz power line voltage and compared to the FCC Part 15 subpart B §15.107 and C §15.207 limits. Measurement bandwidth was 9kHz from 150 kHz to 30 MHz.

Measurement is made with a Rohde & Schwarz ESU8 receiver in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. The LISN (measure) is 50Ω / 50μH.

The Peak data are shown on plots in annex 1. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured.

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

### 6.3. TEST SETUP

The EUT is placed on the ground reference plane, at 80cm from the LISN. The distance between the EUT and the vertical ground plane is 40cm.

The cable has been shorted to 1meter length. The EUT is powered trough the LISN (measure).



**Configuration n°1**



**Configuration n°3**



**6.4. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna horn	EMCO	3115	C2042027
Cable	-	-	A5329578
LISN	RHODE & SCHWARZ	ENV216	C2320123
CALIFORNIA System: 5kVA PSU	SCHAFFNER	NSG 1007	A7043026
Digital Radiocommunication Tester	ROHDE & SCHWARZ	CMU200	A2440004
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204

**6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None

**6.6. TEST SEQUENCE AND RESULTS**

Measurements are performed on the phase (L1) and neutral (N) of power line voltage.  
Graphs are obtained in PEAK detection.  
Measures are also performed in Quasi-Peak and Average for any strong signal.

Measure on L1:	graph Emc#1	Configuration n°1	(see annex 1)
Measure on N:	graph Emc#2	Configuration n°1	(see annex 1)
Measure on L1:	graph Emc#3	Configuration n°3	(see annex 1)
Measure on N:	graph Emc#4	Configuration n°3	(see annex 1)

**RESULT: PASS**

## 7. RADIATED EMISSION DATA

### 7.1. TEST CONDITIONS

Date of test : July 25<sup>th</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 986hPa  
Relative humidity : 31%  
Ambient temperature : 21°C

### 7.2. TEST SETUP

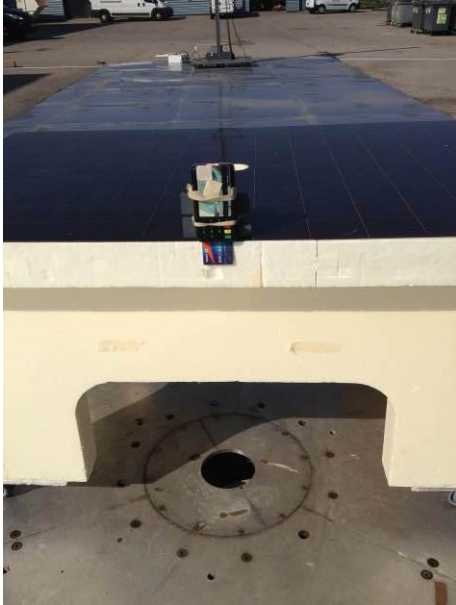
The installation of EUT is identical for pre-characterization measurement in a 3 meters semi anechoic chamber and for measures on a 10 meters Open site.



**Configuration n°1**



L C I E



**Configuration n°2**



**Configuration n°3**



**7.3. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Amplifier 8 GHz	HEROTEK	A1080304A	A7102024
Amplifier 8-26GHz	ALDETEC	ALS01452	A7102026
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052
Antenna Bi-log	CHASE	CBL6111A	C2040172
Antenna horn	EMCO	3115	C2042027
Antenna horn 26GHz	SCHWARZBECK	BBHA 9170	C2042028
Cable N/N	-	-	A5329038
Cable	UTIFLEX	-	A5329192
Cable N/N	-	-	A5329206
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Radiated emission comb generator	BARDET	-	A3169050
High Pass (4.8-18GHz)	BL Microwave	SH4800-1800	A7484034
Band Rejector (2.4GHz/9kHz-6GHz)	BL Microwave	BR2445-200-7CSJ	A7484043
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Spectrum Analyzer 9KHz – 26.5GHz	HEWLETT PACKARD	8593E	A4060018
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444
Antenna Bi-log	CHASE	CBL6111A	C2040051
Cable	SUCOFLEX	106G	A5329061
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329188
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329199
OATS	-	-	F2000409
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403
Table	MATURO Gmbh	-	F2000437
Table	LCIE	-	F2000438
Cable	-	-	A5329183
Cable	UTIFLEX	-	A5329189
Cable	-	-	A5329191
Semi-Anechoic chamber #1	SIEPEL	-	D3044016
Turntable chamber (Cage#1)	MATURO Gmbh	TT 2.0 SI	F2000406
Antenna mast (Cage#1)	MATURO Gmbh	AM 4.0	F2000407
Turntable controller (Cage#1)	MATURO Gmbh	Control Unit	F2000408

**7.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None



**7.5. TEST SEQUENCE AND RESULTS**

**7.5.1. Pre-characterization at 3 meters [9kHz-30MHz]**

A pre-scan of all the setup has been performed in a 3 meters semi anechoic chamber. The distance between EUT and antenna is 3 meters. For Pre-characterization, the loop antenna was rotated during the test for maximized the emission measurement. Measurement performed on 3 axis of EUT. Frequency band investigated is 9kHz to 30MHz.

**7.5.2. Pre-characterization [30MHz-25GHz]**

For frequency band 30MHz to 1GHz, a pre-scan of all the setup has been performed in a 3 meters semi anechoic chamber.

The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization with a log-periodic antenna. The EUT is being rotated on 360° and on 3 axis during the measurement. The pre-characterization graphs are obtained in PEAK detection.

For frequency band 1GHz to 25GHz, a search is performed in the semi-anechoic chamber in order to determine frequencies radiated by the EUT (Measuring distance reduced to 1m and 20cm for frequencies from 12GHz to 25GHz).

**See graphs for 30MHz-1GHz:**

H polarization	<i>Configuration n°1</i>	<b>Emr#1</b>	(See annex 1)
V polarization	<i>Configuration n°1</i>	<b>Emr#2</b>	(See annex 1)
H polarization	<i>Configuration n°2</i>	<b>Emr#3</b>	(See annex 1)
V polarization	<i>Configuration n°2</i>	<b>Emr#4</b>	(See annex 1)
H polarization	<i>Configuration n°3</i>	<b>Emr#5</b>	(See annex 1)
V polarization	<i>Configuration n°3</i>	<b>Emr#6</b>	(See annex 1)



**7.5.3. Characterization on 10 meters open site below 30 MHz**

The product has been tested according to ANSI C63.4 (2003), FCC part 15 subpart C. Radiated Emissions were measured on an open area test site. A description of the facility is on file with the FCC. The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart C §15.225 limits in the frequency range 13.553MHz 13.567MHz. Measurement bandwidth was 9kHz. Antenna height was 1m for both horizontal and vertical polarization. Antenna was rotated around its vertical axis. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on clauses 3.2.

Frequency (MHz)	QPeak Limit (dBµV/m) @ 30m	Qpeak (dBµV/m)	Qpeak-Limit (Margin dB)	Turntable Angle (deg)	Ant. Pol./ Angle (deg)	Tot Corr (dB)
13.56* <sup>1</sup>	84.0	41.5	-42.5	90	0	35.3

\*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@30m = M@10m-19.1dB)

**Limits Sub clause §15.225**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
13.553-13.567	15 848 84 dBµV/m	30
13.410-13.553 13.567-13.710	334 50.5 dBµV/m	30
13.110-13.410 13.710-14.010	106 40.5 dBµV/m	30



**7.5.4. Characterization on 10 meters open site from 30MHz to 1GHz**

The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 120kHz from 30 MHz to 1GHz. Antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following tables.

**Worst case final data result:**

**Configuration n°1:**

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	PoI	Hgt (cm)	Tot Corr (dB)	Comments
1	37.194	40.0	36.2	-3.8	95	V	100	14.7	-
2	38.045	40.0	33.9	-6.1	100	V	100	14.3	-
3	39.676	40.0	35.9	-4.1	105	V	100	13.7	-
4	135.675	43.5	31.2	-12.3	180	V	110	15.2	-
5	204.960	43.5	26.5	-17.0	95	V	150	12.8	-
6	312.920	46.0	31.4	-14.6	120	V	130	17.2	-
7	387.050	46.0	33.8	-12.2	90	V	125	19.7	-
8	580.576	46.0	36.0	-10.0	160	V	100	23.4	-

\*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)  
(M@3m = M@10m+10.5dB)

**Configuration n°2:**

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	PoI	Hgt (cm)	Tot Corr (dB)	Comments
1	40.678	40.0	37.5	-2.5	300	V	100	13.2	Axis Z
2	67.799	40.0	29.2	-10.8	210	V	100	7.6	Axis Z
3	325.009	46.0	35.4	-10.6	320	V	100	17.6	Axis Z
4	375.011	46.0	38.1	-7.9	0	V	100	19.3	Axis Z
5	425.012	46.0	38.1	-7.9	0	V	130	20.5	Axis Z
6	500.001	46.0	39.3	-6.7	0	V	120	21.7	Axis Z
7	625.013	46.0	43.9	-2.1	10	V	150	24.2	Axis Z
8	675.012	46.0	43.5	-2.5	30	V	100	24.9	Axis Z
9	725.022	46.0	40.4	-5.6	0	V	150	25.6	Axis Z
10	750.014	46.0	40.7	-5.3	0	V	120	26.0	Axis Z

\*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)  
(M@3m = M@10m+10.5dB)

**Configuration n°3:**

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	PoI	Hgt (cm)	Tot Corr (dB)	Comments
1	30.457	40.0	31.9	-8.1	345	V	100	18.0	Axis Z
2	41.718	40.0	31.6	-8.4	210	V	100	12.7	Axis Z
3	67.592	40.0	28.8	-11.2	285	V	100	7.6	Axis Z
4	114.111	43.5	31.1	-12.4	0	V	100	14.6	Axis Z
5	130.534	43.5	33.4	-10.1	45	V	130	15.7	Axis Z
6	387.048	46.0	39.1	-6.9	180	H	225	19.7	Axis Z
7	433.902	46.0	40.4	-5.6	110	V	245	20.7	Axis Z

\*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)  
(M@3m = M@10m+10.5dB)





**7.5.5. Characterization on 3 meters anechoic chamber from 1GHz to 25GHz**

The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 1MHz from 1GHz to 25GHz. Antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following tables.

**Frequency band 1GHz to 25GHz**

Only Bluetooth harmonic observed.  
Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

**Configuration n°3: (Worst case)**

No	Frequency (GHz)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	4804	54	43.2	-10.8	185	H	100	35.1	DH5 / Axis Z
2	7206	54	42.4	-11.6	180	H	100	37.3	DH5 / Axis Z
3	4882	54	43.0	-11.0	185	H	100	35.2	DH5 / Axis Z
4	7323	54	42.1	-11.9	180	H	100	37.4	DH5 / Axis Z
5	4960	54	42.6	-11.4	185	H	100	35.4	DH5 / Axis Z
6	7440	54	42.3	-11.7	180	H	100	37.5	DH5 / Axis Z

No	Frequency (GHz)	Limit Peak (dBµV/m)	Measure Peak (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	4804	74	68.3	-5.7	185	H	100	35.1	DH5 / Axis Z
2	7206	74	71.5	-2.5	180	H	100	37.3	DH5 / Axis Z
3	4882	74	66.7	-7.3	185	H	100	35.2	DH5 / Axis Z
4	7323	74	68.9	-5.1	180	H	100	37.4	DH5 / Axis Z
5	4960	74	65.4	-8.6	185	H	100	35.4	DH5 / Axis Z
6	7440	74	68.8	-5.2	180	H	100	37.5	DH5 / Axis Z

Note: Measures have been done at 3m distance.

**RESULTS: PASS**



## 7.6. FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength
- RA = Receiver Amplitude
- AF = Antenna Factor
- CF = Cable Factor
- AG = Amplifier Gain

Assume a receiver reading of 52.5dB $\mu$ V is obtained. The antenna factor of 7.4 and a cable factor of 1.1 are added. The amplifier gain of 29dB is subtracted, giving a field strength of 32 dB $\mu$ V/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$

The 32 dB $\mu$ V/m value can be mathematically converted to its corresponding level in  $\mu$ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32\text{dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m.}$$



## 8. MAXIMUM PEAK OUTPUT POWER (15.247)

### 8.1. TEST CONDITIONS

Date of test : July 24<sup>th</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 988hPa  
Relative humidity : 31%  
Ambient temperature : 24°C

### 8.2. EQUIPMENT CONFIGURATION

Modulation: 8DPSK (worst case)  
Packet Type: DH5 (worst case)  
Hopping sequence: NO (worst case)

### 8.3. SETUP

#### *Radiated measurement:*

The product has been tested at a distance of 3 meters from the antenna and using 3MHz RBW and 10MHz VBW. Antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT.

A summary of the worst case emissions found in all test configurations and modes is shown on following table.

The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where:

- E is the measured maximum fundamental field strength in V/m, utilizing a RBW  $\geq$  the 20 dB bandwidth of the emission, VBW > RBW, peak detector function. Follow the procedures in C63.4-1992 with respect to maximizing the emission.

- G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.

- d is the distance in meters from which the field strength was measured.

- P is the power in watts for which you are solving:

$$P = \frac{(Ed)^2}{30G}$$

**8.4. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna horn	EMCO	3115	C2042029
Cable	-	-	A5329183
Cable	UTIFLEX	-	A5329189
Cable	-	-	A5329191
Semi-Anechoic chamber #1	SIEPEL	-	D3044016
Radiated emission comb generator	BARDET	-	A3169050
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer (C1)	LACROSS Techn.	WS-2357	B4206014
Turntable chamber (Cage#1)	MATURO Gmbh	TT 2.0 SI	F2000406
Antenna mast (Cage#1)	MATURO Gmbh	AM 4.0	F2000407
Turntable controller (Cage#1)	MATURO Gmbh	Control Unit	F2000408
Table	MATURO Gmbh	-	F2000437

**8.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

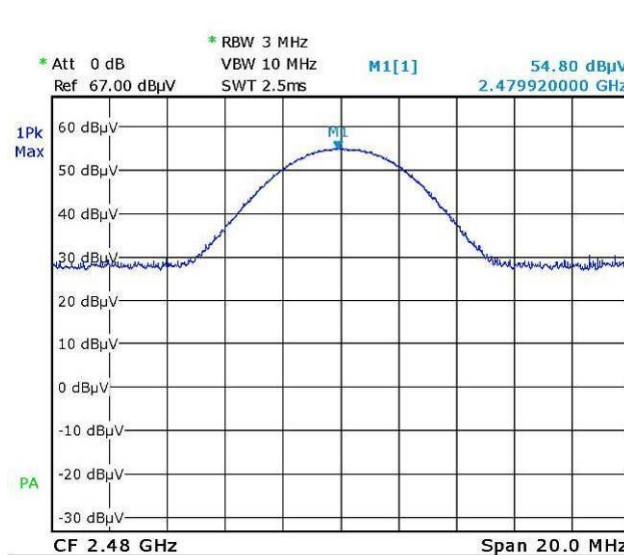
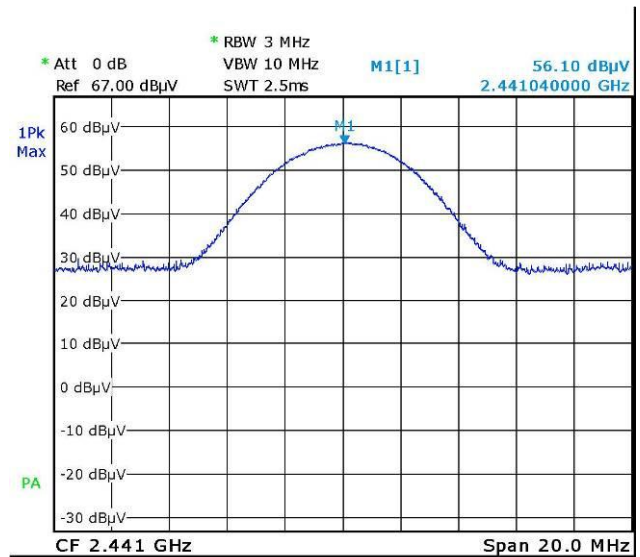
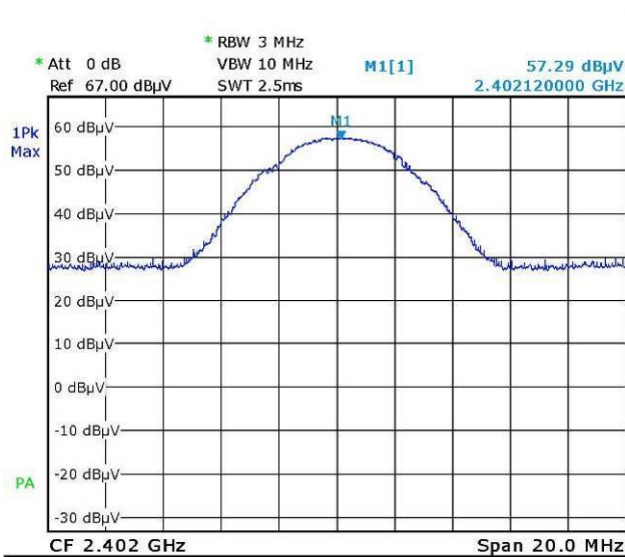
None



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**Radiated measurement, conducted not possible:**

Channel	Channel Frequency (MHz)	Maximum Field (dBµV/m)	Peak Output Power (dBm)	Power Limit (dBm)	FC (dB)	PASS / FAIL
0	2402	88.9	-6.3	21	31.6	PASS
39	2441	87.7	-7.5	21	31.6	PASS
78	2480	86.4	-8.8	21	31.6	PASS



**9. HOPPING CHANNEL SEPARATION (15.247)****9.1. TEST CONDITIONS**

Date of test : July 25<sup>th</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 986hPa  
Relative humidity : 31%  
Ambient temperature : 21°C

**9.1. LIMIT**

For frequency hopping system operating in the 2400-2483.5MHz, if the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB Bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

**9.2. EQUIPMENT CONFIGURATION**

Modulation: all  
Packet Type: all  
Hopping sequence: ON

**9.3. SETUP – 20DB BANDWIDTH**

The EUT is placed in an anechoic chamber; levels have been corrected to be in compliant with the Peak Output Power measured. The EUT is turn ON and using the MaxHold function, the frequency separation of two frequencies that were attenuated 20dB from the Peak Output Power level. A delta marker is used to measure the frequency difference as the emission bandwidth.

**9.4. SETUP – ADJACENT CHANNEL SEPARATION**

The EUT is placed in an anechoic chamber; levels have been corrected to be in compliant with the Peak Output Power measured. The EUT is turn ON and using the MaxHold function, the separation of two adjacent channels is recorded. A delta marker is used to measure the frequency difference.

**9.5. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna horn	EMCO	3115	C2042029
Cable N/N	-	-	A5329038
Cable	UTIFLEX	-	A5329192
Cable N/N	-	-	A5329206
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer	OREGON	BAR206	B4204078

**9.6. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None



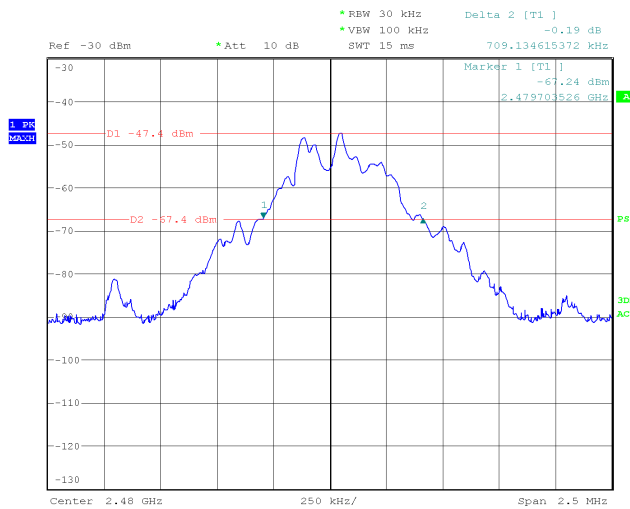
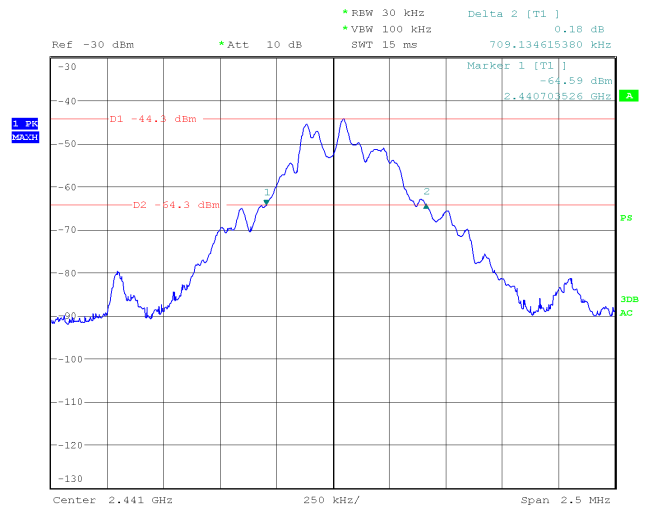
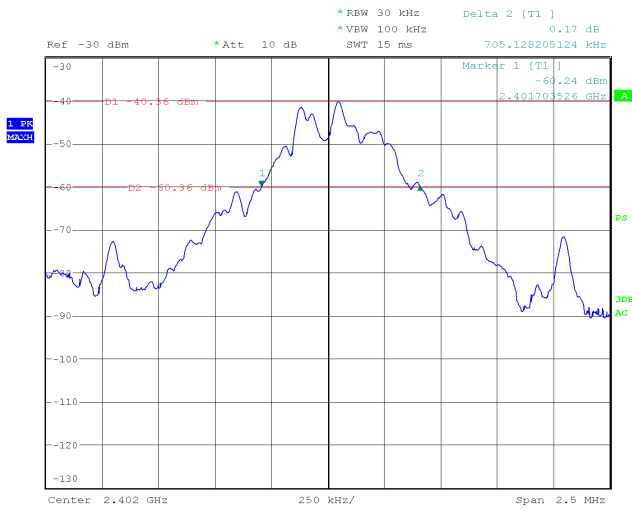
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9.7. RESULTS

Modulation: GFSK – DH1

Channel	Channel Frequency (MHz)	Adjacent Channel Separation (MHz)	20dB Bandwidth (MHz)	Minimum Limit (MHz)	PASS / FAIL
0	2402	1.001	0.705	0.470	PASS
39	2441	1.001	0.709	0.473	PASS
78	2480	1.001	0.709	0.473	PASS

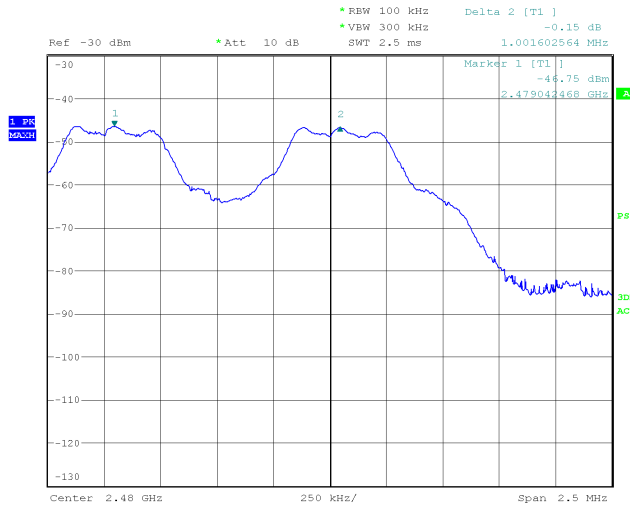
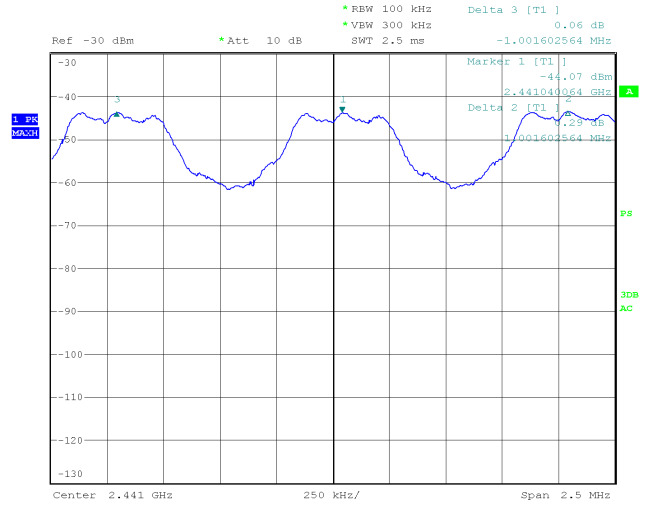
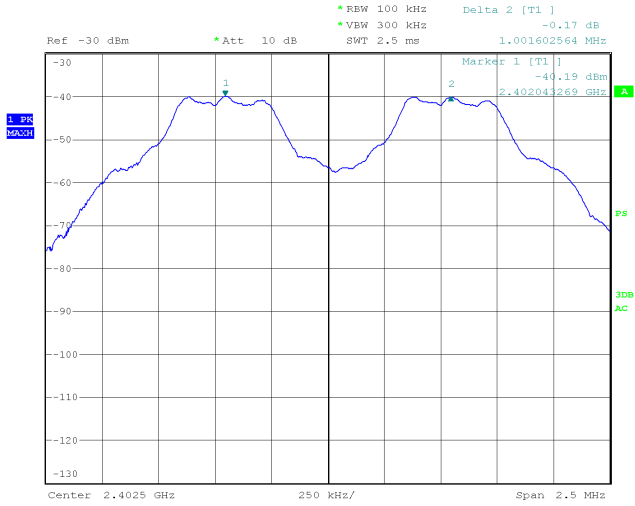
Limit used: Two-third 20dB Bandwidth







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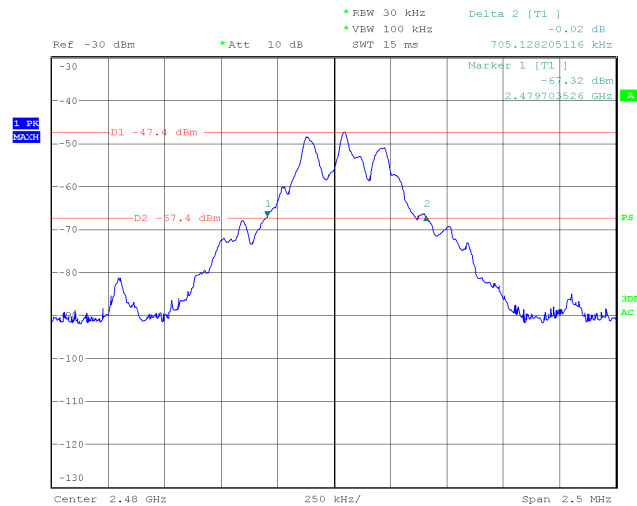
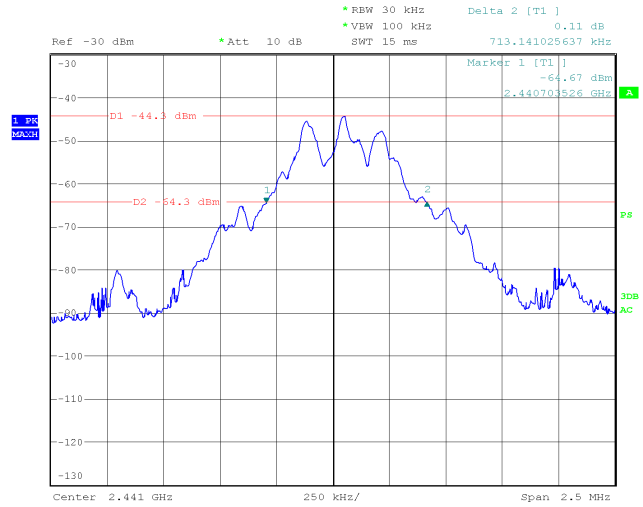
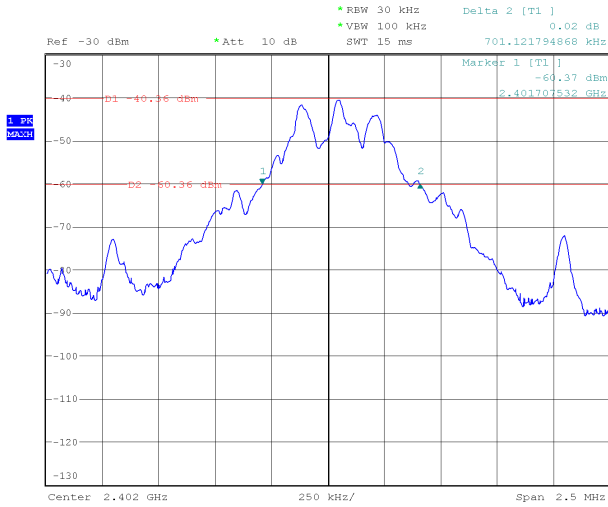


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**Modulation: Pi/4 DQPSK – DH3**

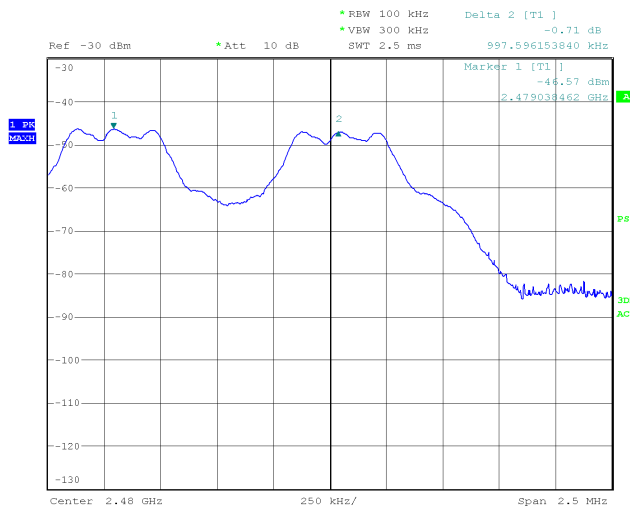
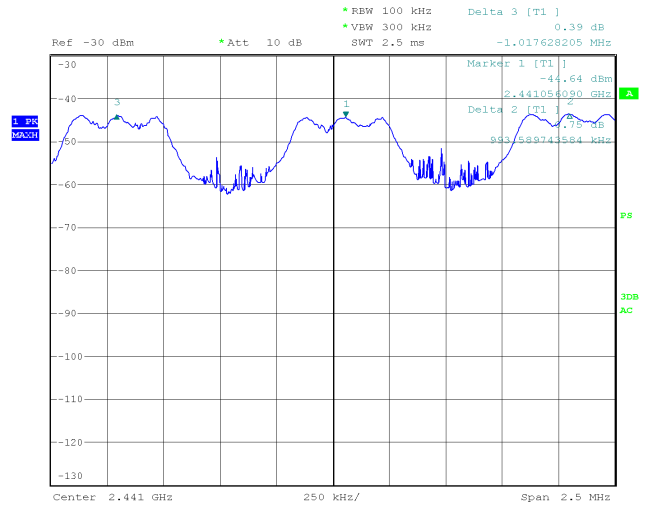
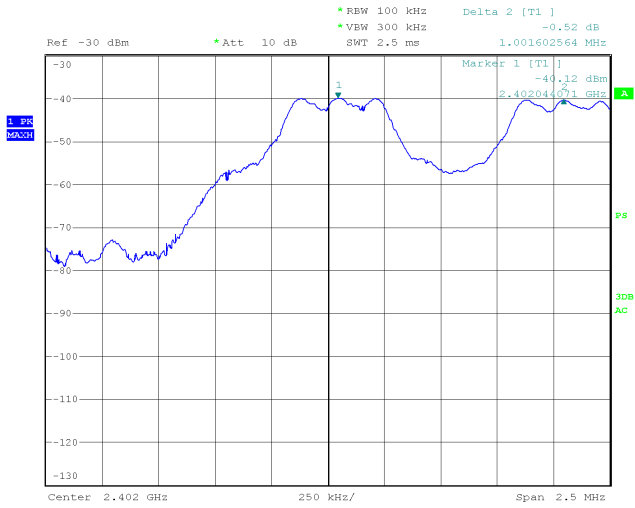
Channel	Channel Frequency (MHz)	Adjacent Channel Separation (MHz)	20dB Bandwidth (MHz)	Minimum Limit (MHz)	PASS / FAIL
0	2402	1.001	0.701	0.468	PASS
39	2441	0.993	0.713	0.476	PASS
78	2480	0.997	0.705	0.470	PASS

Limit used: Two-third 20dB Bandwidth





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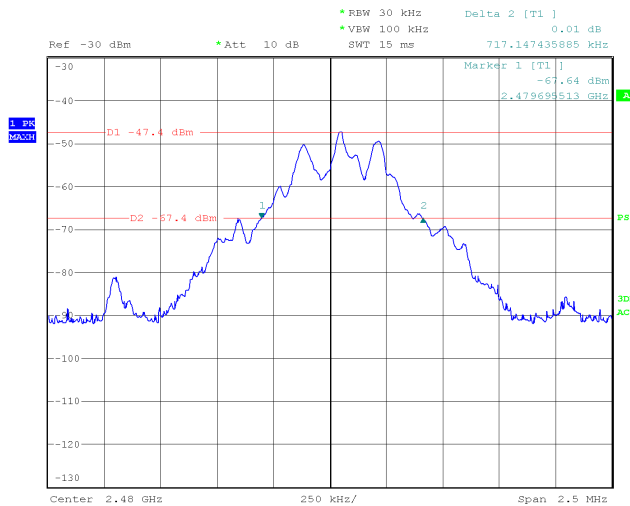
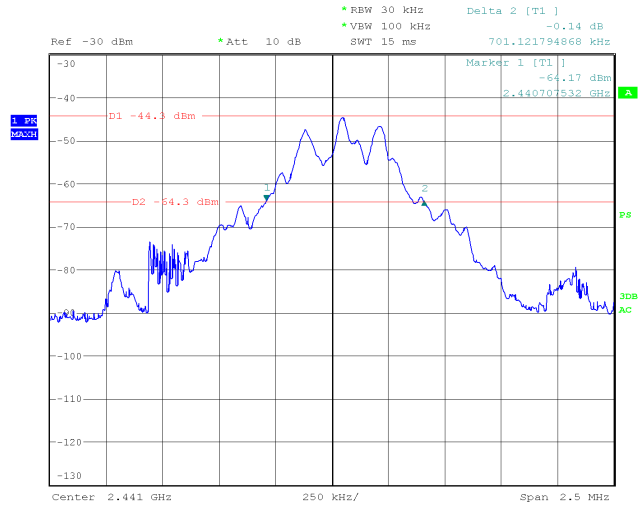
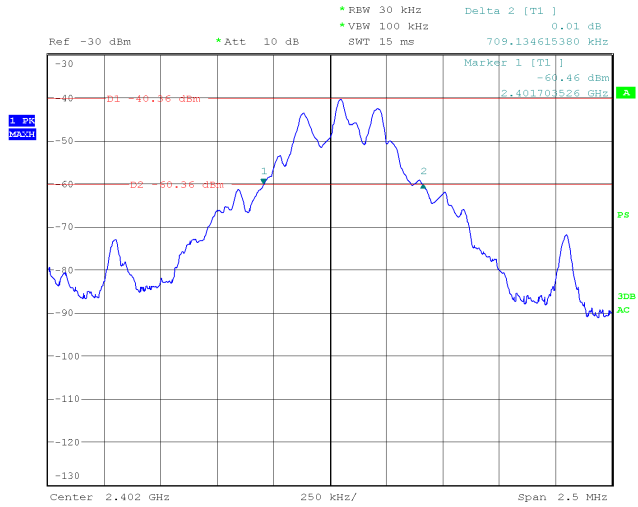


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**Modulation: 8DPSK – DH5**

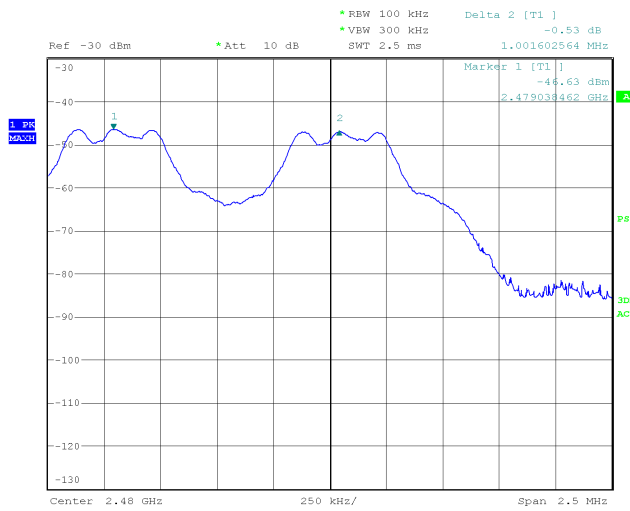
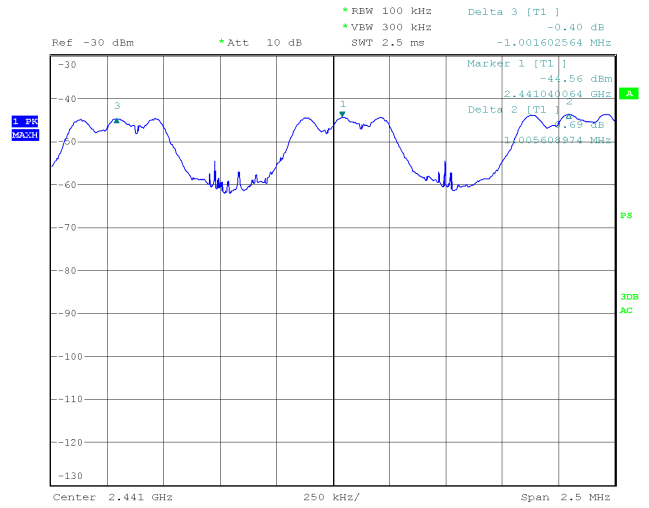
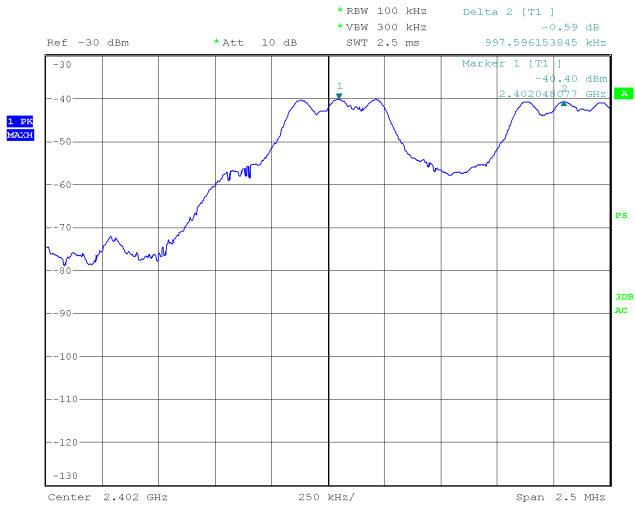
Channel	Channel Frequency (MHz)	Adjacent Channel Separation (MHz)	20dB Bandwidth (MHz)	Minimum Limit (MHz)	PASS / FAIL
0	2402	0.997	0.709	0.473	PASS
39	2441	1.001	0.701	0.468	PASS
78	2480	1.001	0.717	0.478	PASS

Limit used: Two-third 20dB Bandwidth





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**10. NUMBER OF HOPPING FREQUENCIES (15.247)**

**10.1. TEST CONDITIONS**

Date of test : July 20<sup>th</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 996hPa  
Relative humidity : 33%  
Ambient temperature : 22°C

**10.1. LIMIT**

For frequency hopping system operating in the 2400-2483.5MHz, at least 15 channels frequencies must be used and should be equally spaced.

**10.2. EQUIPMENT CONFIGURATION**

Modulation: GFSK  
Packet Type: DH5 / DH3 / DH1 same results – Different configurations, same results.  
Hopping sequence: ON

**10.3. SETUP**

The EUT is placed in an anechoic chamber. The EUT is turn ON and using the MaxHold function and a delta marker the number of frequencies used for this FHSS system is recorded, see following graphs.

RBW: 100kHz  
VBW: 300kHz

**10.4. TEST EQUIPMENT LIST**

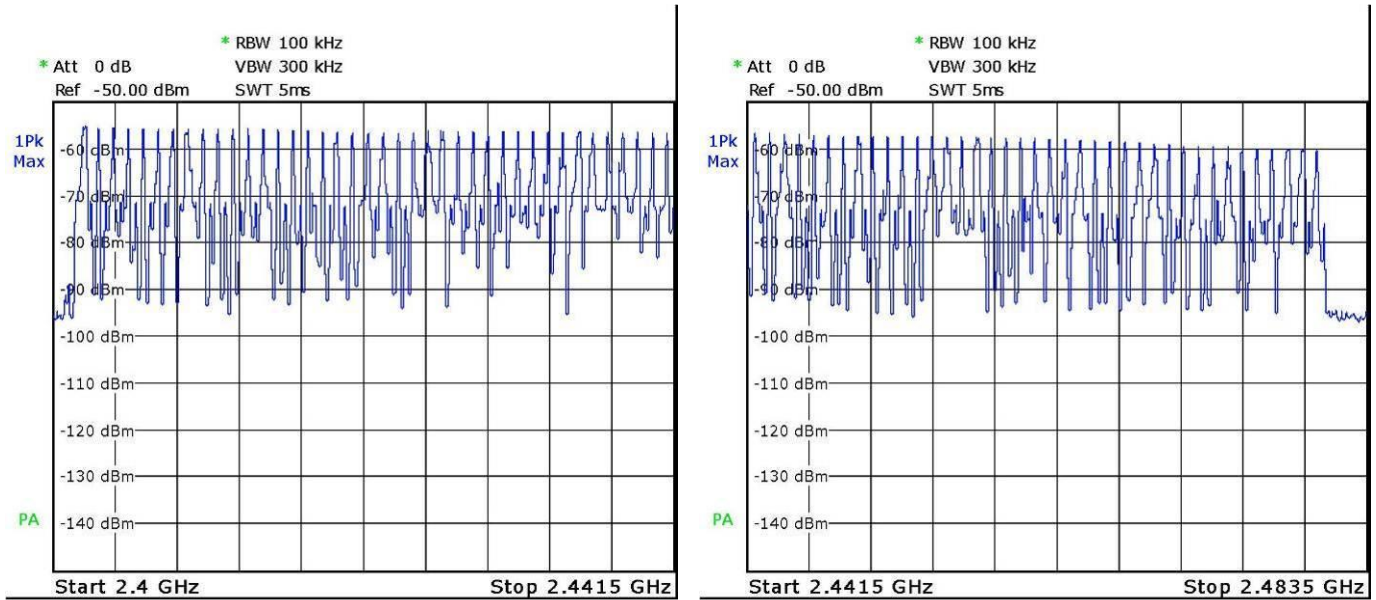
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna horn	EMCO	3115	C2042029
Cable N/N	-	-	A5329038
Cable	UTIFLEX	-	A5329192
Cable N/N	-	-	A5329206
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer	OREGON	BAR206	B4204078

**10.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None

**10.6. RESULTS**

**GFSK – DH5:**



Number of frequency used in the hopping sequence: 79 channels

**11. TIME OF OCCUPANCY (DWELL TIME) (15.247)****11.1. TEST CONDITIONS**

Date of test : July 20<sup>th</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 996hPa  
Relative humidity : 33%  
Ambient temperature : 22°C

**11.1. LIMIT**

The average time of occupancy on any channel shall not be greater than 0.4 seconds within period of 0.4 seconds multiplied by the number of hopping channels employed.

**11.2. EQUIPMENT CONFIGURATION**

Modulation: GFSK  
Packet Type: DH5 / DH3 / DH1.  
Hopping sequence: ON

**11.3. SETUP**

The EUT is placed in an anechoic chamber. The EUT is turn ON; the Dwell Time is measured and calculated using the zero SPAN mode on a channel frequency and a SWEEP with an adapter value to measure the number of transmission within a period and the time of transmission

RBW: 100kHz  
VBW: 300kHz

**11.4. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna horn	EMCO	3115	C2042029
Cable N/N	-	-	A5329038
Cable	UTIFLEX	-	A5329192
Cable N/N	-	-	A5329206
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer	OREGON	BAR206	B4204078

**11.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None





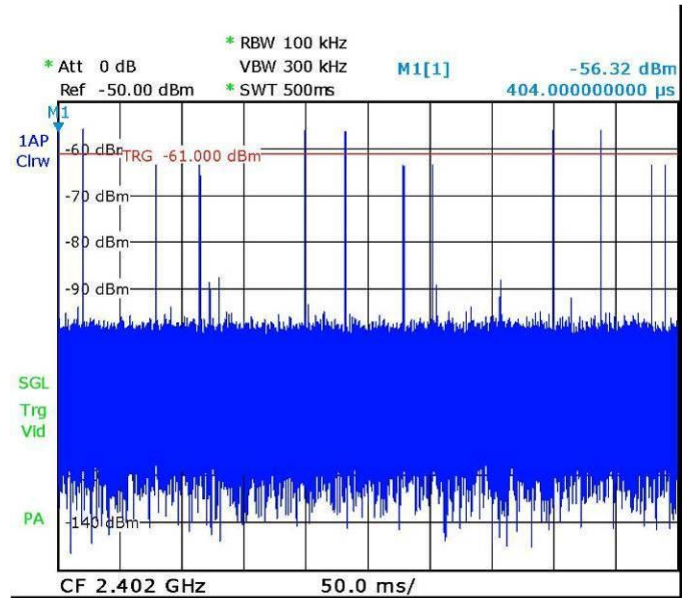
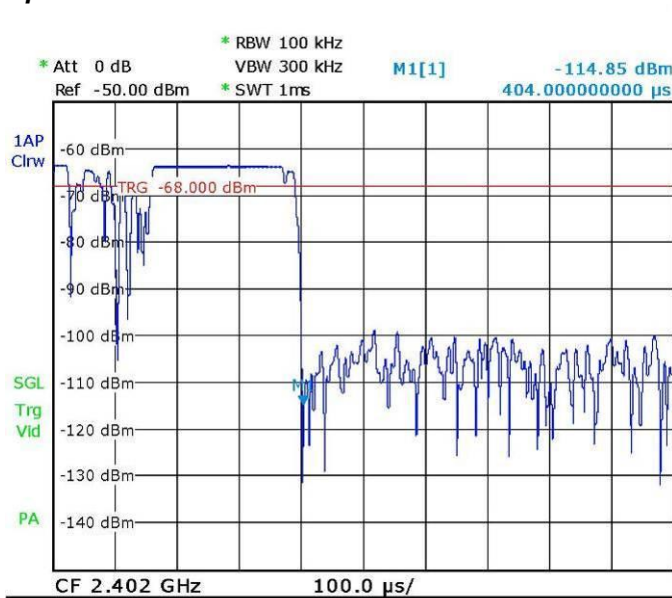
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11.6. RESULTS

Packet Mode	Number of transmission in the period	Length of transmission time (ms)	Result (ms)	Limit (ms)	PASS / FAIL
DH1	6 (times/ 0.5sec) * tps de transmit	0.404	154	400	PASS
DH3	20 (times/ 5sec) * tps de transmit	1.680	213	400	PASS
DH5	15 (times/ 5sec) * tps de transmit	2.940	279	400	PASS

**Note:** Period of 31.6 seconds (79 channels x 0.4)

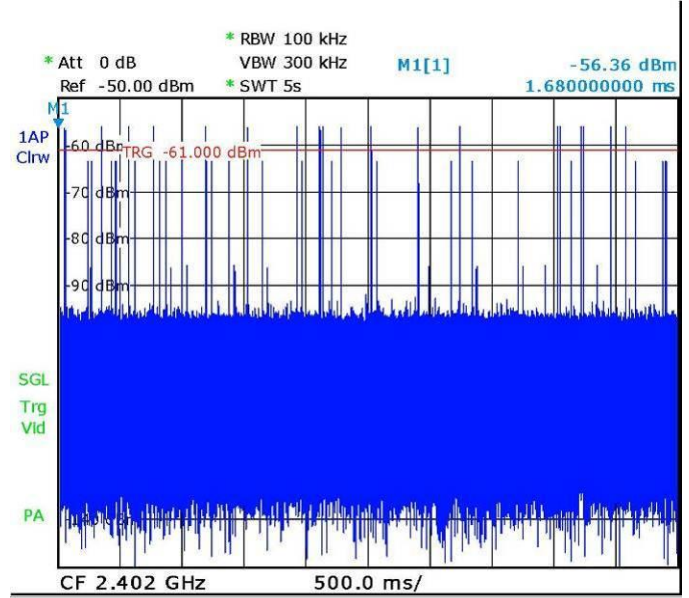
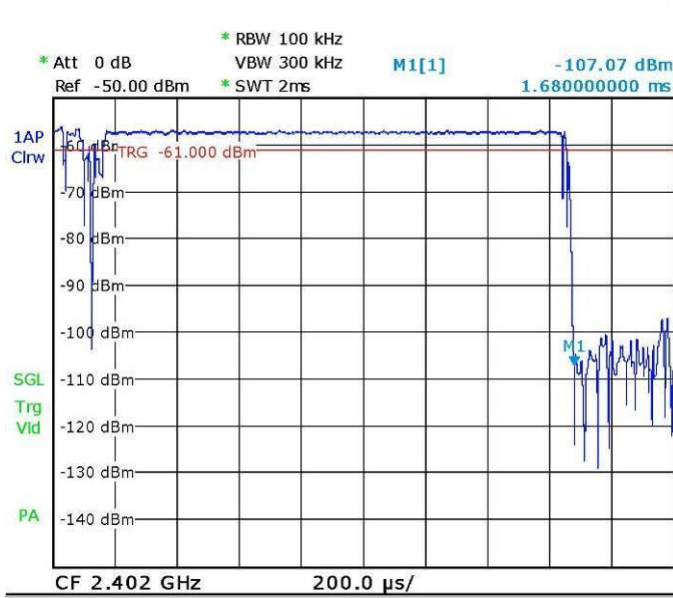
Graphs: DH1





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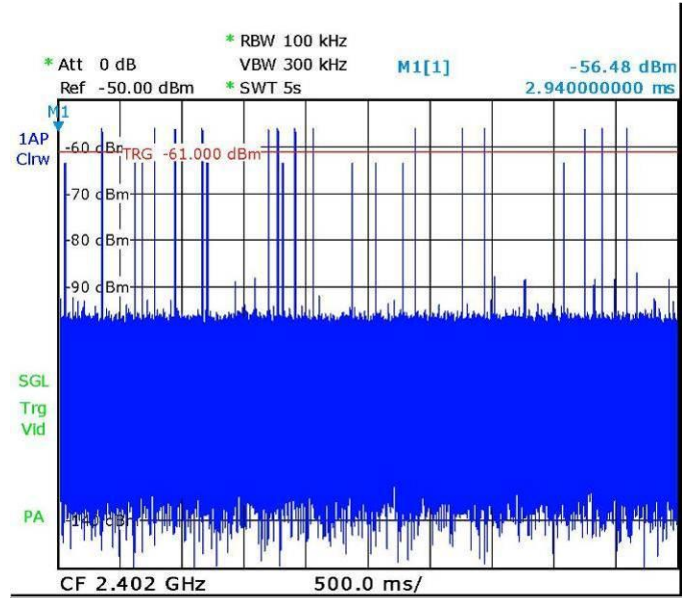
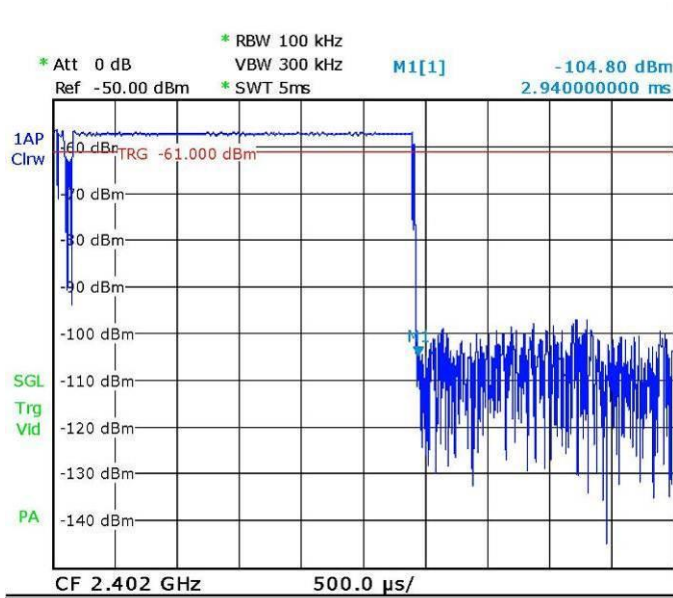
Graphs: DH3





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Graphs: DH5



**12. BAND EDGE MEASUREMENT (15.247)****12.1. TEST CONDITIONS**

Date of test : July 25<sup>th</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 986hPa  
Relative humidity : 31%  
Ambient temperature : 21°C

**12.2. LIMIT**

In Bandedge, the limit of spurious emissions are below -20dB of the highest emission level of operating band (in 100kHz RBW).

In the restrict band (2310-2390MHz) and (2483.5-2500MHz) including bandedge, the limit of spurious emissions are 15.209. (RBW: 1MHz / VBW: 1MHz)

**12.3. EQUIPMENT CONFIGURATION**

Modulation: 8DPSK (worst case)  
Packet Type: DH5 (worst case)  
Hopping sequence: ON (worst case)

**12.4. SETUP**

The EUT is placed in an anechoic chamber; the EUT is turn ON; the graphs of the restrict frequency band are recorded with a display line indicating the highest level and other the 20dB offset below to show compliance with 15.247 (d) and 15.205. The emissions in restricted bands are compared to 15.209 limits.

RBW: 100kHz  
VBW: 300kHz



**12.5. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna horn	EMCO	3115	C2042027
Antenna horn 26GHz	SCHWARZBECK	BBHA 9170	C2042028
Cable N/N	-	-	A5329038
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Spectrum Analyzer 9KHz – 26.5GHz	HEWLETT PACKARD	8593E	A4060018

**12.6. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None

**12.7. TEST SEQUENCE AND RESULTS**

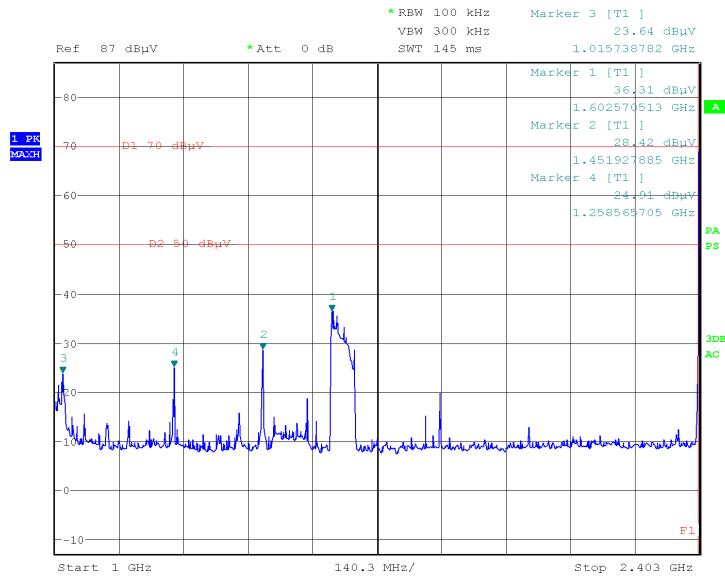
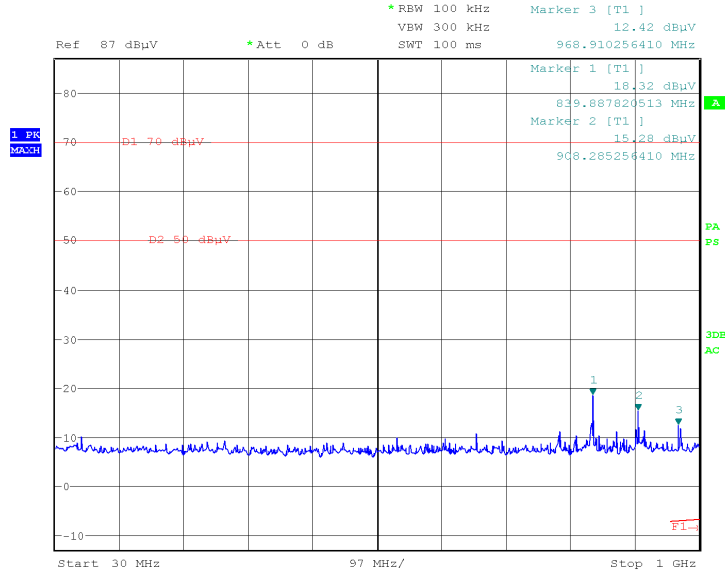
**Restricted Band**

Frequency (MHz)	Maximum field strength in restrict band (dBµV/m)	Limit (dBµV/m)	Detector
968.910	34.7	54.0	PK
1015.738	45.2	74.0	PK
1015.738	33.1	54.0	AV
1451.928	49.7	74.0	PK
1451.928	30.1	54.0	AV
1602.571	57.5	74.0	PK
1602.571	43.2	54.0	AV



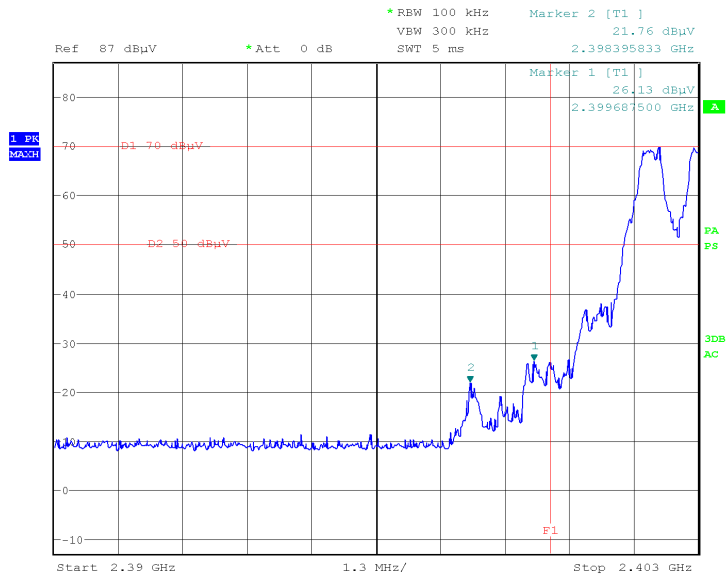
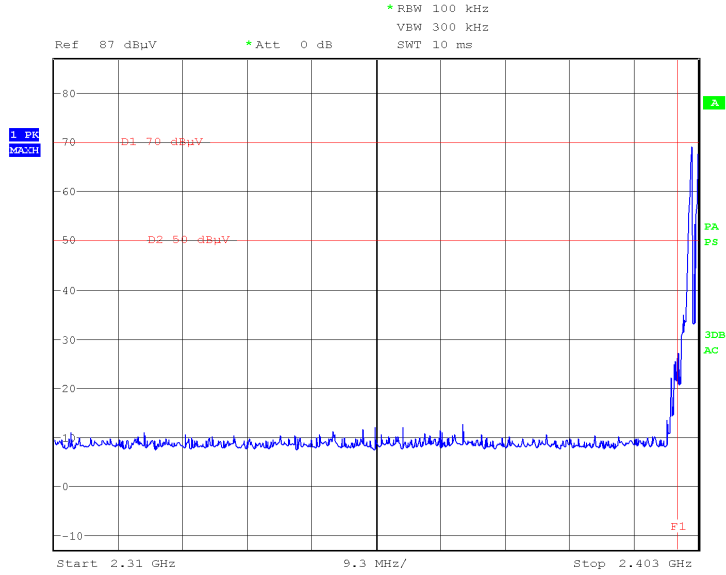
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Screenshots of measurement, worst case presented:



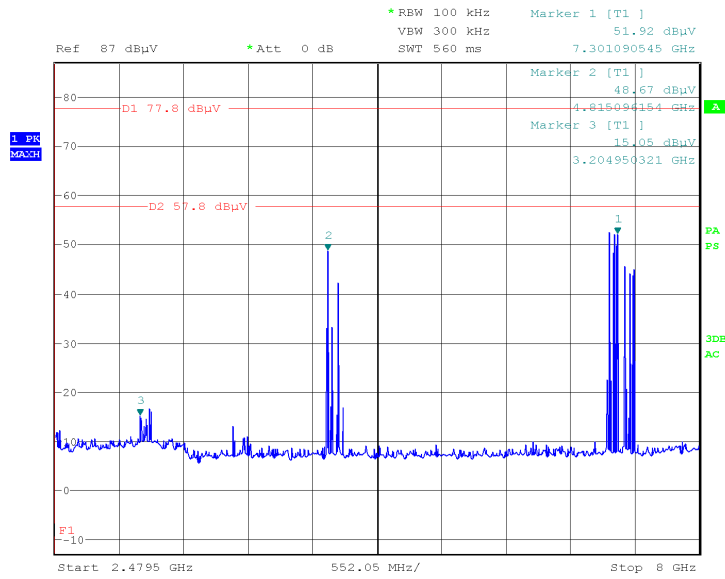
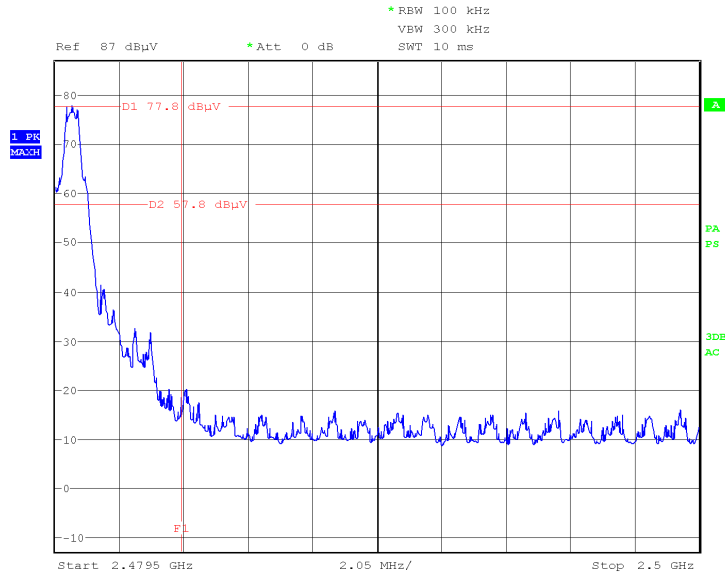


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None frequency observed above 8GHz.

Note: For frequencies from 8GHz to 26GHz, it isn't possible to export screenshots.





**13. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)**

**13.1. TEST CONDITIONS**

Test performed by : A.MERLIN  
 Date of test : July 24<sup>th</sup>, 2012  
 Ambient temperature : 24°C  
 Relative humidity : 31%

**13.1. TEST SETUP**

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency when the temperature is varied from -20°C to +50°C at the nominal power voltage and the primary power voltage is varied from 85% to 115% of the rated supply voltage at 20°C.

**13.2. TEMPERATURE AND VOLTAGE FLUCTUATION**

Temperature has been set at +20°C, -20°C, -30°C and +50°C.  
 The voltage is varied from 3.5VDC to 4.3VDC, last regulation of power supply of RF module (worst case). Minimal voltage declared by INGENICO, below RFID module is disabled.  
 Frequency of carrier: 13.56 MHz  
 Upper limit: 13.561356 MHz  
 Lower limit: 13.558644 MHz  
 The equipment (RF box) is set in a climatic chamber. Measure is performed on one channel of RF module.

Voltage	Temperature	-30°C	-20°C	20°C	+50°C
Mains voltage: 3.7VDC Frequency Drift (MHz) Carrier level (dBc)		+ 0.000025 + 0.90	+ 0.000018 + 0.70	<b>REFERENCE</b> <b>REFERENCE</b>	+ 0.000009 + 0.30
Mains voltage: 3.5VDC Frequency Drift (MHz) Carrier level (dBc)		+ 0.000025 + 0.80	+ 0.000018 + 0.70	+ 0.000000 + 0.00	+ 0.000009 + 0.30
Mains voltage: 4.3VDC Frequency Drift (MHz) Carrier level (dBc)		+ 0.000025 + 0.90	+ 0.000018 + 0.70	+ 0.000000 + 0.00	+ 0.000008 + 0.30

Frequency drift measured is **25 Hz** when the temperature is varied from -30°C to +50°C and voltage is varied from 3.50VDC to 4.3VDC.

**13.3. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Passive loop antenna	EMCO	7405-901	A2240015
Antenna horn	EMCO	3115	C2042027
Cable N/N	-	-	A5329206
Cable SMA	-	-	A5329580
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117
Digital Radiocommunication Tester	ROHDE & SCHWARZ	CMU200	A2440004
Multimeter	FLUKE	289	A1240230
Power supply DC	TTi	PL320	A7040059
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020

**13.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None

**14. BAND-EDGE COMPLIANCE §15.209****14.1. TEST CONDITIONS**

Date of test : July 23<sup>rd</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 1007mb  
Relative humidity : 33%  
Ambient temperature : 21°C

**14.2. TEST EQUIPMENT LIST**

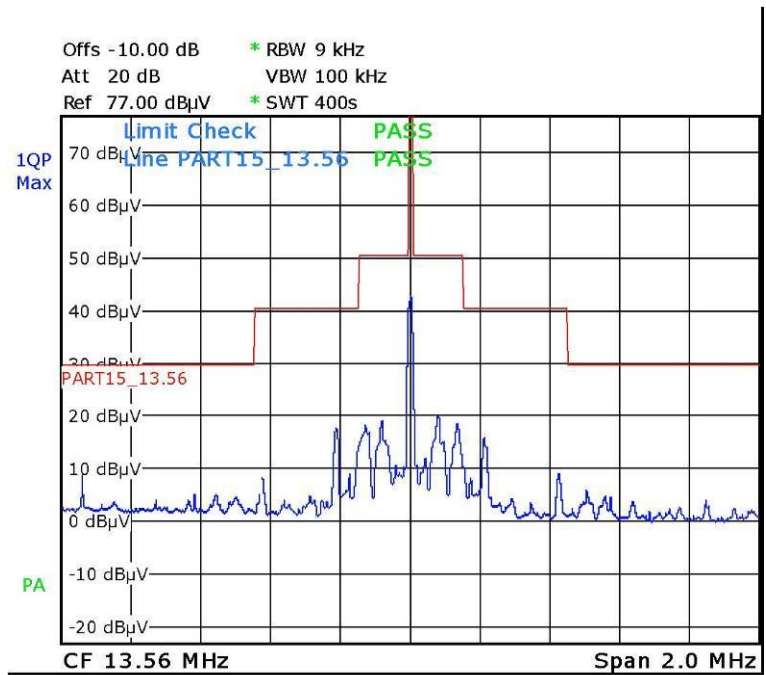
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052
Cable	SUCOFLEX	106G	A5329061
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329188
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329199
OATS	-	-	F2000409
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Thermo-hygrometer	OREGON	BAR206	B4204078
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403
Table	MATURO GmbH	-	F2000437

**14.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None

**14.4. FREQUENCY BAND 13.110-14.010MHZ AND 13.553-13.567MHZ**

Following plot shows radiated emission level with a RBW of 9kHz and a quasi-peak detector. The graphs are obtained with a measuring receiver ESU8.



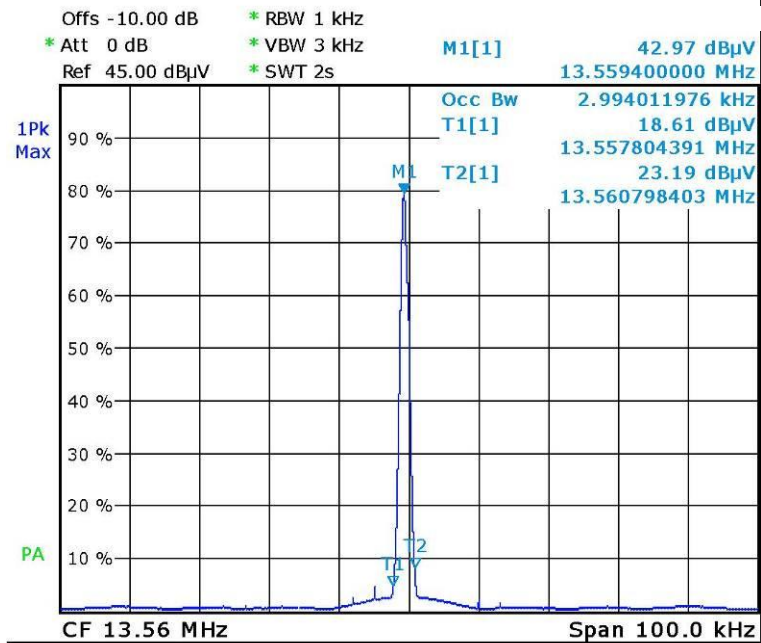


**15. OCCUPIED BANDWIDTH**

**15.1. CLIMATIC CONDITIONS**

Date of test : July 20<sup>th</sup>, 2012  
Test performed by : A.MERLIN  
Atmospheric pressure : 996hPa  
Relative humidity : 33%  
Ambient temperature : 22°C

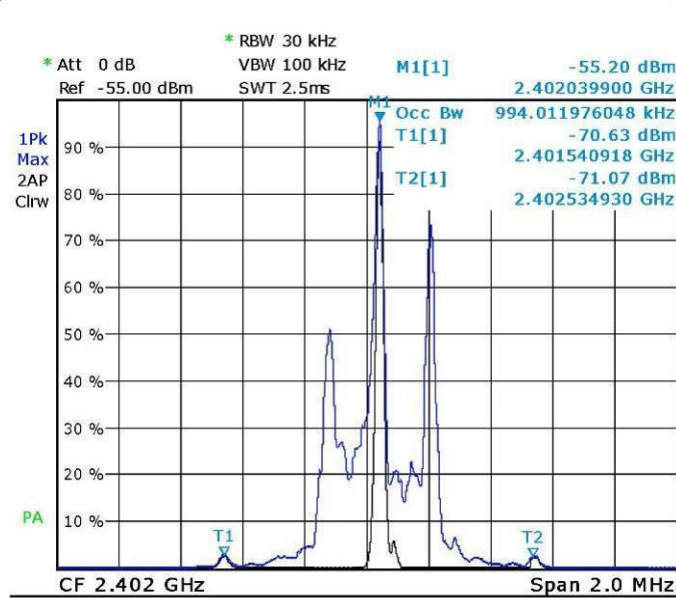
**15.1. TEST RESULTS**



Measured occupied bandwidth is **2.99 kHz**

Measurement settings:  
RBW = 1kHz / Video BW = 3kHz / SPAN = 100kHz  
Linear unit

**Bluetooth - DH5 (Worst case)**



Measured occupied bandwidth is **994kHz** (same results followings channels).

Measurement settings:  
 RBW = 30kHz / Video BW = 100kHz / SPAN: 2MHz  
 Linear unit

**15.2. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna horn	EMCO	3115	C2042029
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052
Cable N/N	-	-	A5329038
Cable	UTIFLEX	-	A5329192
Cable N/N	-	-	A5329206
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer	OREGON	BAR206	B4204078

**15.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

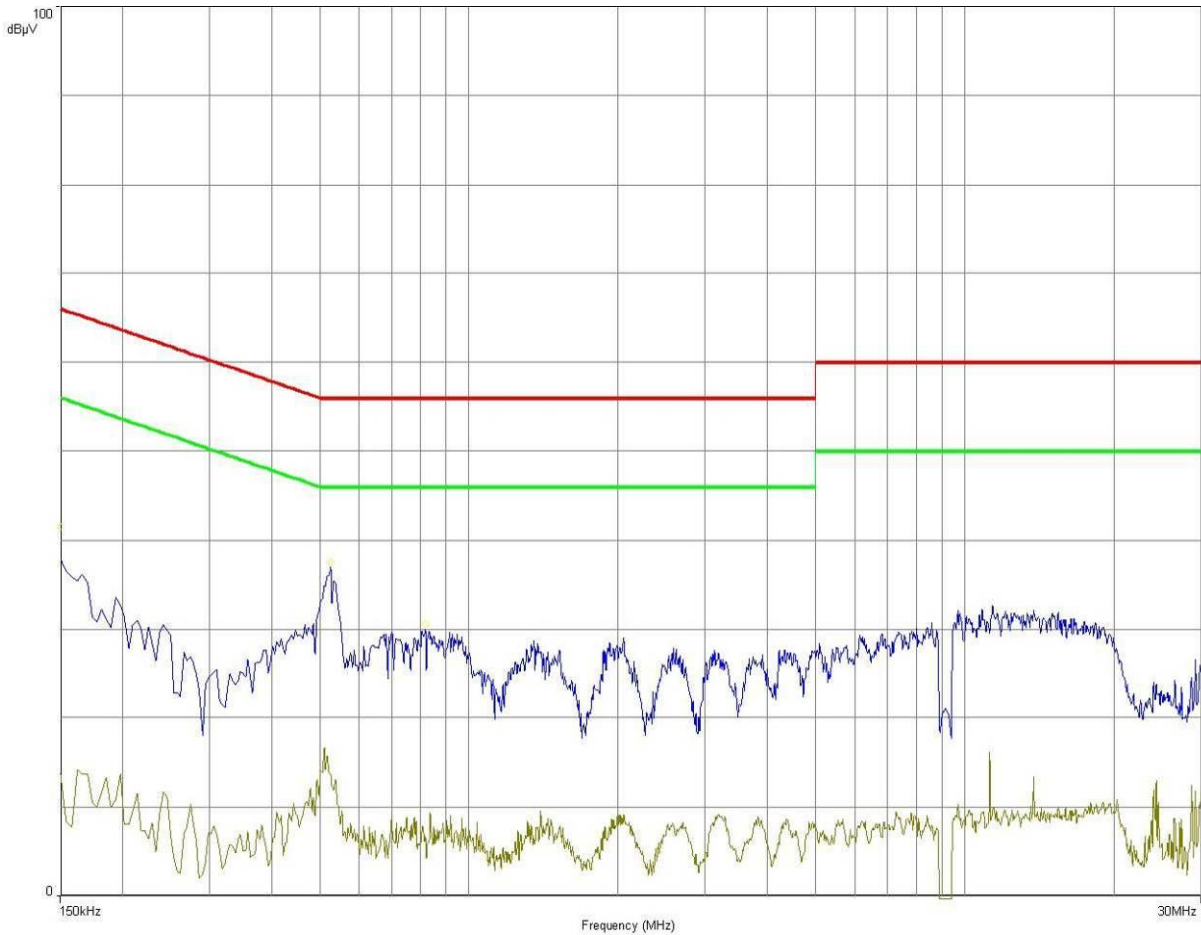
None



L C I E

16. ANNEX 1 (GRAPHS)

CONDUCTED EMISSIONS			
Graph name :	Emc#1	Test configuration: n°1	
Limit :	EN 55022	With base	
Class :	B		
PARAMETERS			
Voltage / Frequency :	110VAC/60Hz	Legend:	
Line :	Phase	Peak Measure	Average Measure
RBW :	9kHz		
VBW :	30kHz	QPeak Limit	Average Limit
Frequency :	150kHz- 30MHz		

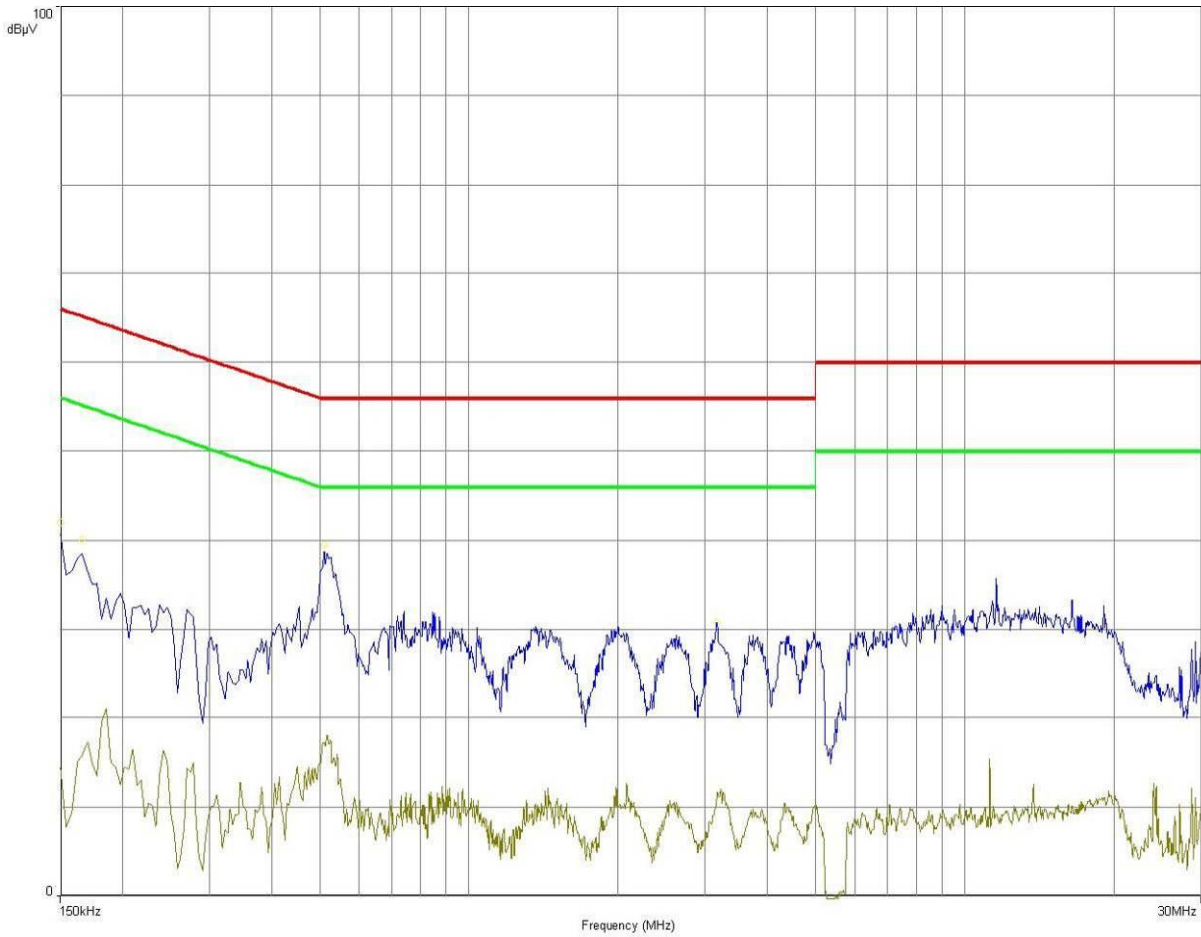


Frequency (MHz)	Avg (dBµV)	Lim Avg (dBµV)	Avg-LimAvg (dBµV)	QPeak (dBµV)	LimQPeak (dBµV)	QPeak-LimQPeak (dBµV)
0.150	16.97	56.00	-39.03	32.68	66.00	-33.32
0.526	14.15	46.00	-31.85	32.51	56.00	-23.49
0.818	5.68	46.00	-40.32	24.76	56.00	-31.24
2.050	7.35	46.00	-38.65	22.61	56.00	-33.39
9.682	7.62	50.00	-42.38	25.44	60.00	-34.56
11.402	7.20	50.00	-42.80	25.00	60.00	-35.00



L C I E

CONDUCTED EMISSIONS		
Graph name :	Emc#2	Test configuration: n°1
Limit :	EN 55022	With base
Class :	B	
PARAMETERS		
Voltage / Frequency :	110V/60Hz	Legend:
Line :	Neutral	Peak Measure
RBW :	9kHz	Average Measure
VBW :	30kHz	QPeak Limit
Frequency :	150kHz- 30MHz	Average Limit



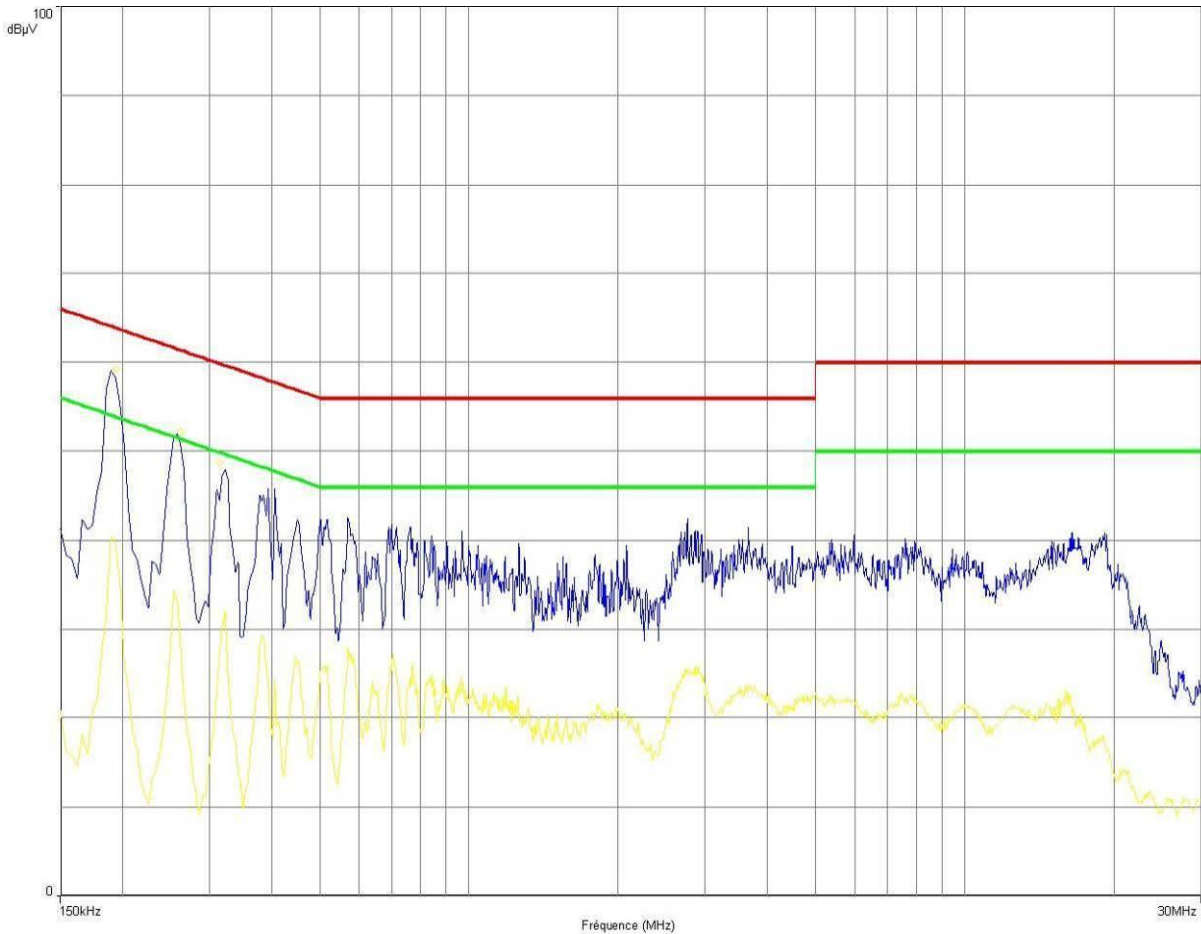
Frequency (MHz)	Avg (dBµV)	Lim Avg (dBµV)	Avg-LimAvg (dBµV)	QPeak (dBµV)	LimQPeak (dBµV)	QPeak-LimQPeak (dBµV)
0.150	17.05	56.00	-38.95	31.89	66.00	-33.32
0.166	16.86	55.16	-38.30	34.24	65.16	-23.49
0.510	17.72	46.00	-28.28	34.73	56.00	-31.24
0.738	8.86	46.00	-37.14	24.18	56.00	-33.39
3.162	8.81	46.00	-37.19	23.31	56.00	-34.56
11.574	7.32	50.00	-42.68	25.31	60.00	-35.00





L C I E

CONDUCTED EMISSIONS		
Graph name :	Emc#3	Test configuration: n°3
Limit :	EN 55022	
Class :	B	
PARAMETERS		
Voltage / Frequency :	110VAC / 60Hz	Legend:
Line :	Phase	Peak Measure
RBW :	9kHz	Average Measure
VBW :	30kHz	QPeak Limit
Frequency :	150kHz- 30MHz	Average Limit

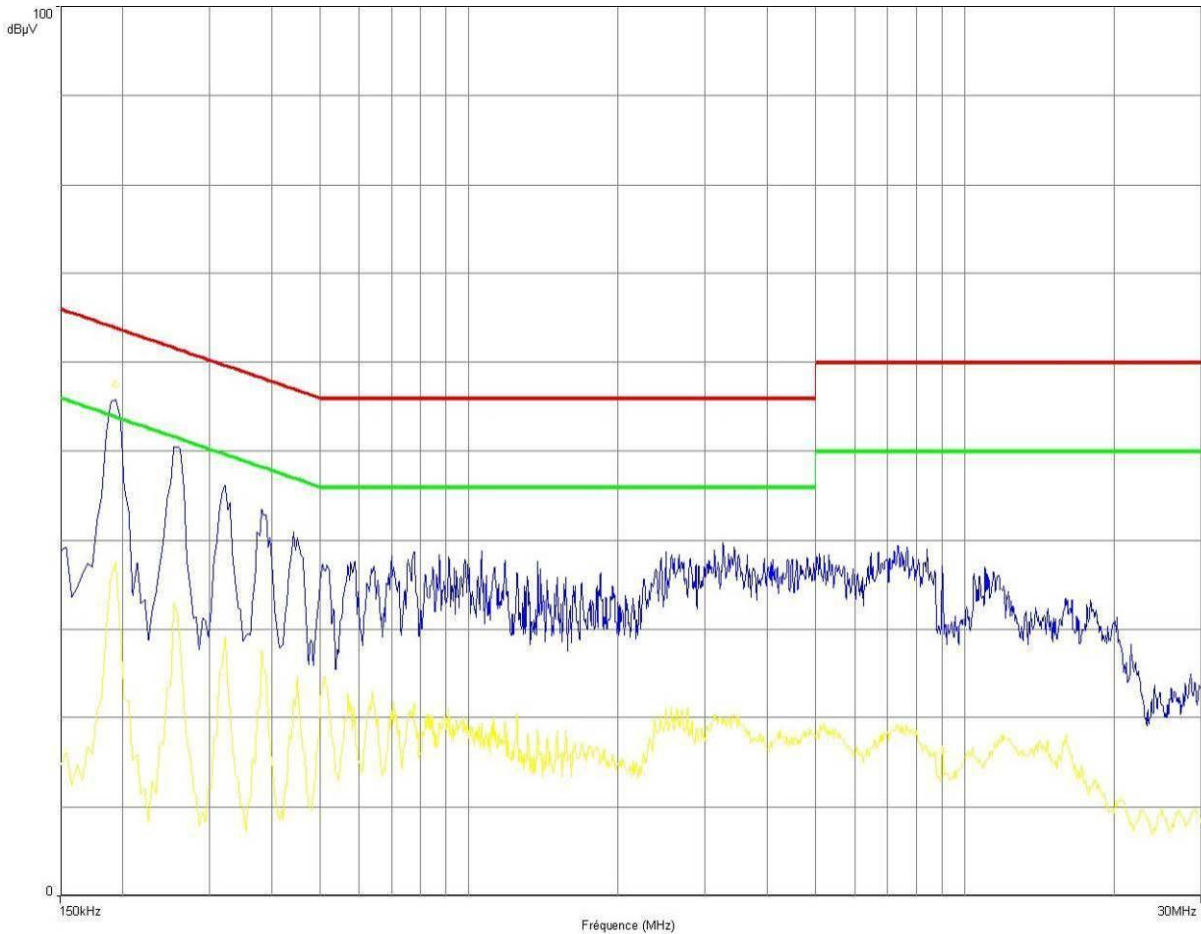


Frequency (MHz)	Avg (dBµV)	Lim Avg (dBµV)	Avg-LimAvg (dBµV)	QPeak (dBµV)	LimQPeak (dBµV)	QPeak-LimQPeak (dBµV)
0.194	40.56	53.86	-13.30	56.72	63.86	-7.14
0.262	28.46	51.37	-22.91	46.22	61.37	-15.15



L C I E

CONDUCTED EMISSIONS		
Graph name :	Emc#4	Test configuration: n°3
Limit :	EN 55022	
Class :	B	
PARAMETERS		
Voltage / Frequency :	110VAC / 60Hz	Legend:
Line :	Neutral	Peak Measure
RBW :	9kHz	Average Measure
VBW :	30kHz	QPeak Limit
Frequency :	150kHz- 30MHz	Average Limit



Frequency (MHz)	Avg (dBµV)	Lim Avg (dBµV)	Avg-LimAvg (dBµV)	QPeak (dBµV)	LimQPeak (dBµV)	QPeak-LimQPeak (dBµV)
0.194	38.33	53.86	-15.53	54.75	63.86	-9.11



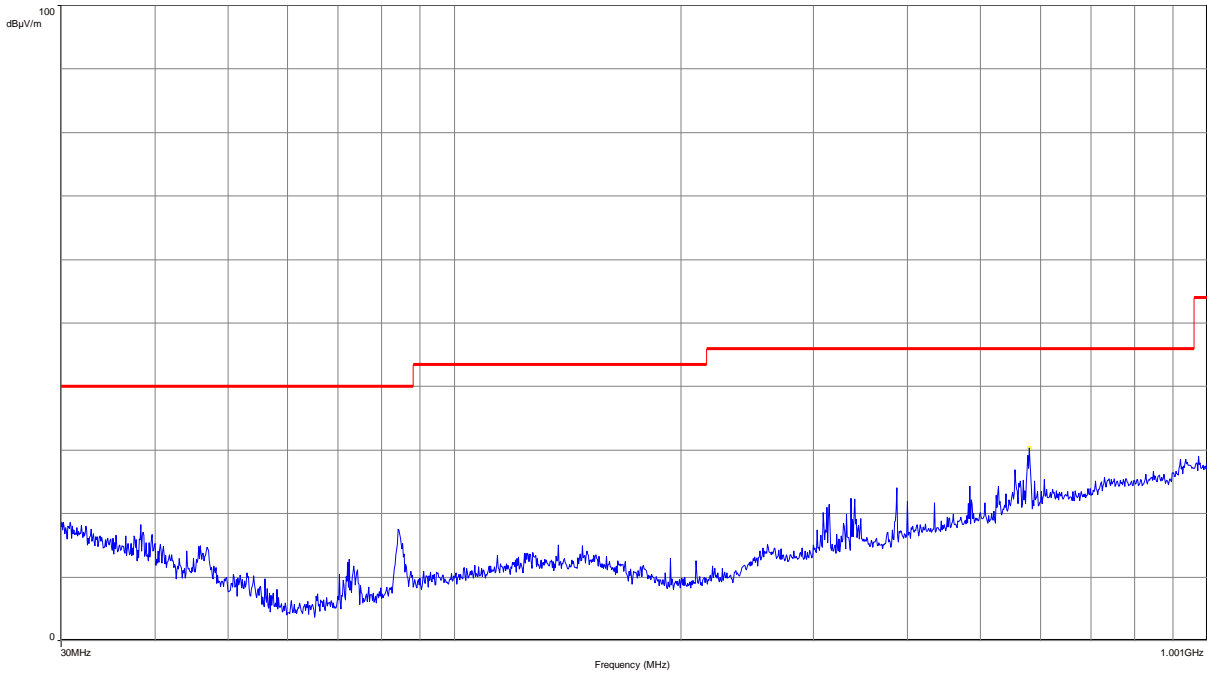
L C I E

**RADIATED EMISSIONS**

<b>Graph name :</b>	Emr#1	<b>Test configuration: n°1</b>
<b>Limit :</b>	FCC Part15C	With base
<b>Class :</b>	B	

**PARAMETERS**

<b>Antenna polarization:</b>	Horizontale	<b>Legend:</b>
<b>Azimuth :</b>	0° - 360°	Peak Measure
<b>RBW :</b>	100kHz	QPeak Limit@3m
<b>VBW :</b>	300kHz	
<b>Frequency :</b>	30MHz- 1.001GHz	



Frequency (MHz)	Peak (dBµV/m)
580.6	30.33



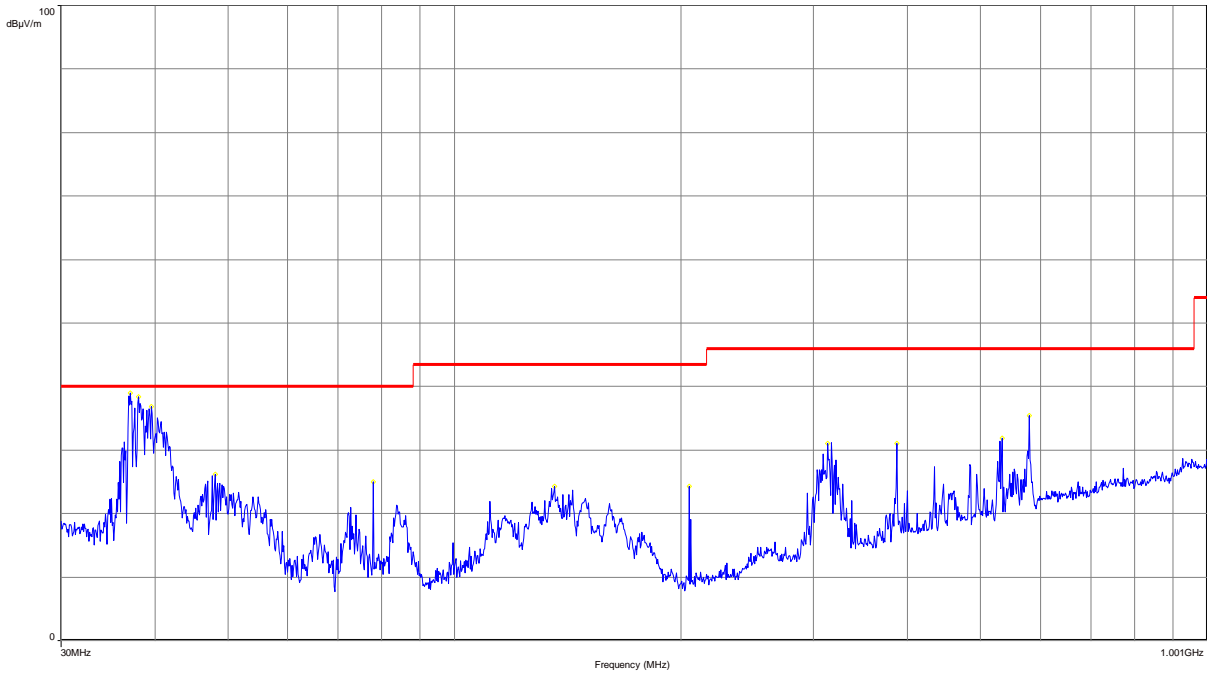
L C I E

**RADIATED EMISSIONS**

<b>Graph name :</b>	Emr#2	<b>Test configuration: n°1</b>
<b>Limit :</b>	FCC Part15C	With base
<b>Class :</b>	B	

**PARAMETERS**

<b>Antenna polarization:</b>	Verticale	<b>Legend:</b>
<b>Azimuth :</b>	0° - 360°	<span style="background-color: blue; color: white;">█</span> Peak Measure
<b>RBW :</b>	100kHz	<span style="background-color: red; color: white;">█</span> QPeak Limit@3m
<b>VBW :</b>	300kHz	
<b>Frequency :</b>	30MHz- 1.001GHz	



Frequency (MHz)	Peak (dBµV/m)
37.12	38.97
38.00	38.44
39.52	36.85
48.04	26.13
78.04	24.98
135.64	24.29
204.96	24.28
312.96	31.08
387.08	31.00
534.16	31.87
580.60	35.38





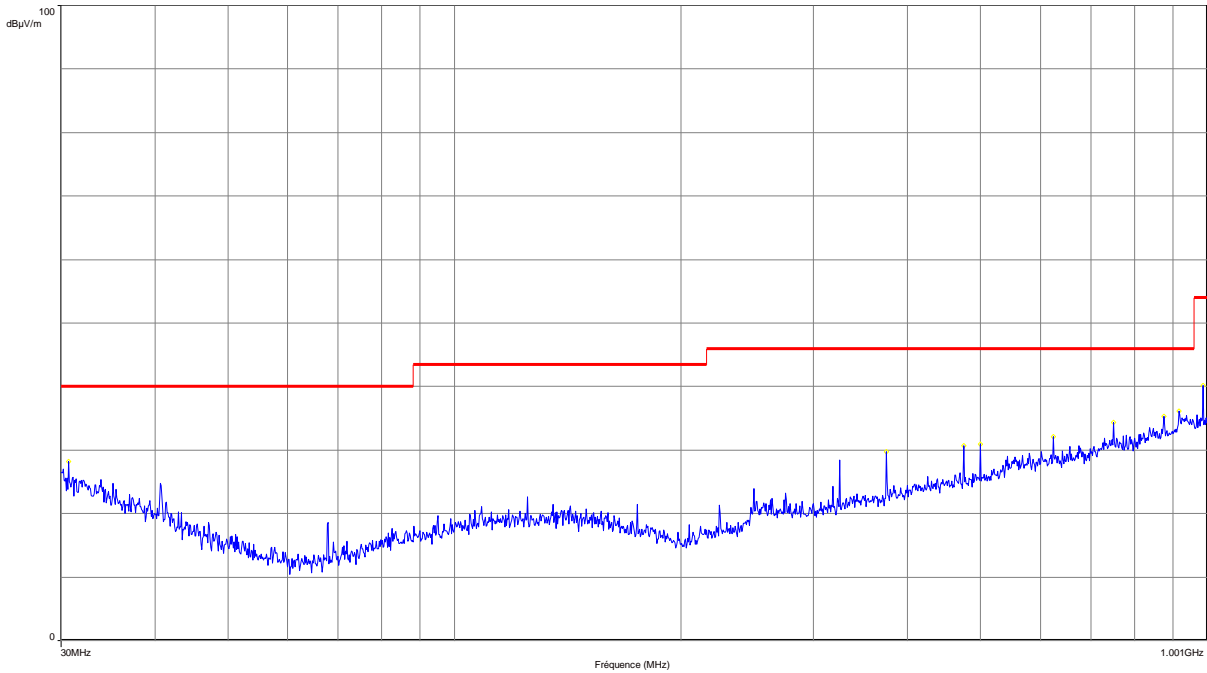
L C I E

**RADIATED EMISSIONS**

<b>Graph name :</b>	Emr#3	<b>Test configuration: n°2</b>
<b>Limit :</b>	FCC Part15C	Battery - Axis Z (Worst case)
<b>Class :</b>	B	

**PARAMETERS**

<b>Antenna polarization:</b>	Horizontale	<b>Legend:</b>
<b>Azimuth :</b>	0° - 360°	 <b>Peak Measure</b>
<b>RBW :</b>	100kHz	 <b>QPeak Limit@3m</b>
<b>VBW :</b>	300kHz	
<b>Frequency :</b>	30MHz- 1.001GHz	



Frequency (MHz)	Peak (dBµV/m)
30.72	28.15
375.00	29.69
475.04	30.65
500.00	30.88
625.04	32.12
750.04	34.42
875.04	35.29
918.24	36.19
987.52	40.21



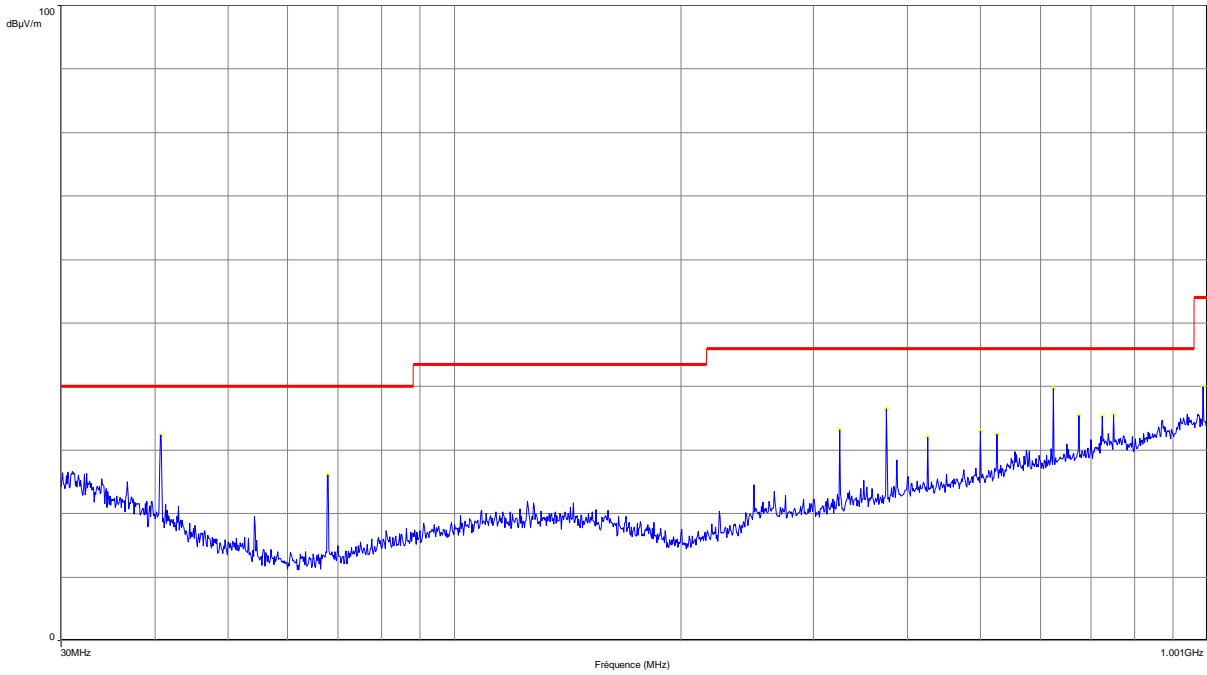
L C I E

**RADIATED EMISSIONS**

<b>Graph name :</b>	Emr#4	<b>Test configuration: n°2</b>
<b>Limit :</b>	FCC Part15C	Battery - Axis Z (Worst case)
<b>Class :</b>	B	

**PARAMETERS**

<b>Antenna polarization:</b>	Verticale	<b>Legend:</b>
<b>Azimuth :</b>	0° - 360°	
<b>RBW :</b>	100kHz	<span style="background-color: blue; color: white;">█</span> Peak Measure
<b>VBW :</b>	300kHz	<span style="background-color: red; color: white;">█</span> QPeak Limit@3m
<b>Frequency :</b>	30MHz- 1.001GHz	



Frequency (MHz)	Peak (dBµV/m)
40.72	32.29
67.84	26.09
325.04	33.18
375.00	36.55
425.04	31.99
500.04	32.97
525.04	32.41
625.08	39.68
675.00	35.39
725.04	35.31
750.00	35.60
987.52	39.97



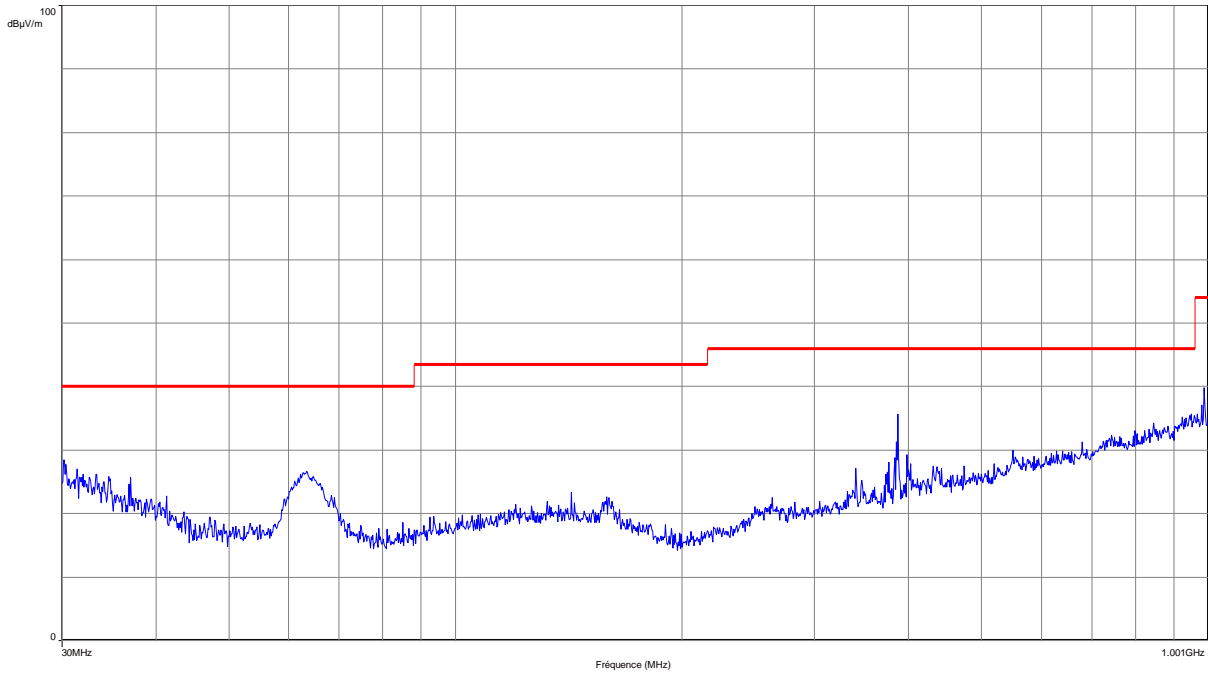
L C I E

**RADIATED EMISSIONS**

<b>Graph name :</b>	Emr#5	<b>Test configuration: n°3</b>
<b>Limit :</b>	FCC Part15C	Power supply USB - Axis Z (Worst case)
<b>Class :</b>	B	

**PARAMETERS**

<b>Antenna polarization:</b>	Horizontale	<b>Legend:</b>
<b>Azimuth :</b>	0° - 360°	Peak Measure
<b>RBW :</b>	100kHz	QPeak Limit@3m
<b>VBW :</b>	300kHz	
<b>Frequency :</b>	30MHz- 1.001GHz	



Frequency (MHz)	Peak (dBµV/m)
64.32	26.98
380.6	36.54



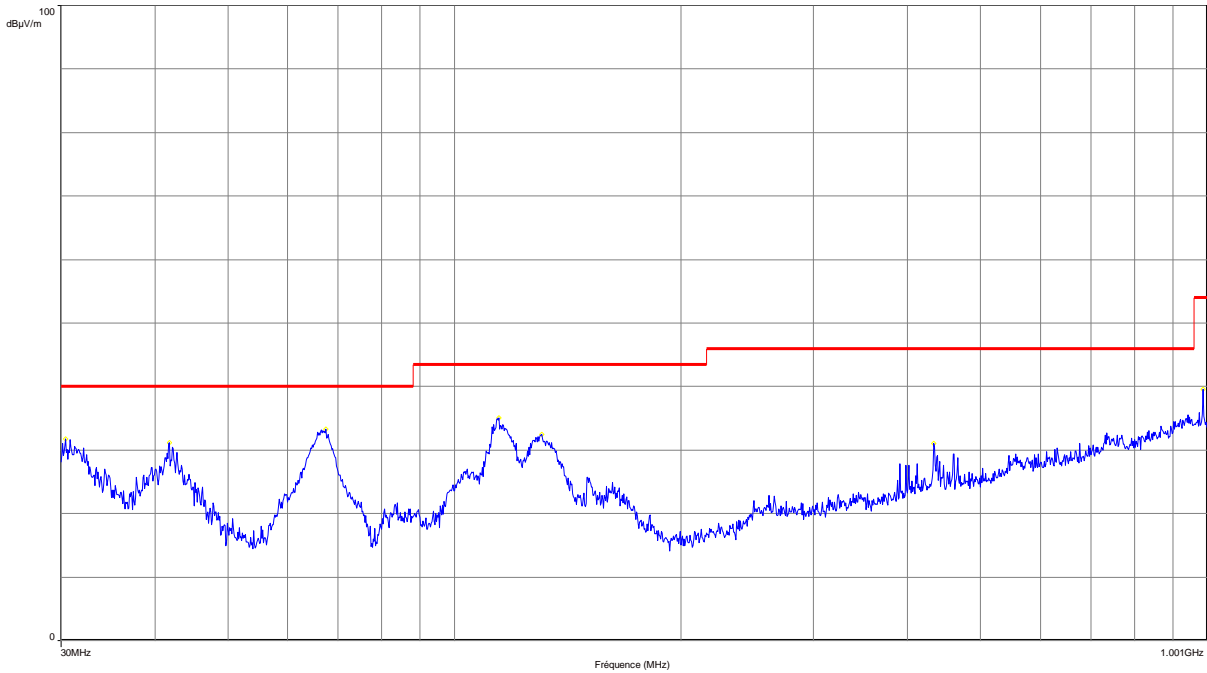
L C I E

**RADIATED EMISSIONS**

<b>Graph name :</b>	Emr#6	<b>Test configuration: n°3</b>
<b>Limit :</b>	FCC Part15C	Power supply USB - Axis Z (Worst case)
<b>Class :</b>	B	

**PARAMETERS**

<b>Antenna polarization:</b>	Verticale	<b>Legend:</b>
<b>Azimuth :</b>	0° - 360°	Peak Measure
<b>RBW :</b>	100kHz	QPeak Limit@3m
<b>VBW :</b>	300kHz	
<b>Frequency :</b>	30MHz- 1.001GHz	



Frequency (MHz)	Peak (dBµV/m)
30.40	31.80
41.76	31.17
67.52	33.35
114.44	35.10
130.44	32.41
433.56	31.01
987.52	39.62





**17. UNCERTAINTIES CHART**

Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) ± x	Incertitude limite du CISPR / CISPR uncertainty limit ± y
Mesure des perturbations conduites en tension sur le réseau d'énergie <i>Measurement of conducted disturbances in voltage on the power port</i>	3.57 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication <i>Measurement of conducted disturbances in voltage on the telecommunication port.</i>	3.28 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension <i>Measurement of discontinuous conducted disturbances in voltage</i>	3.47 dB	3.6 dB
Mesure des perturbations conduites en courant <i>Measurement of conducted disturbances in current</i>	2.90 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Moirans <i>Measurement of radiated electric field on the Moirans open area test site</i>	5.07 dB	5.2 dB

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limits values.