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Rapport d'essai / Test report

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Objet / Subject : Essais de compatibilité électromagnétique conformément aux normes
FCC CFR 47 Part 15, Subpart B
*Electromagnetic compatibility tests according to the standards
FCC CFR 47 Part 15, Subpart B*

Matériel testé / Apparatus under test :

- . Produit / Product : **Clavier pour automate bancaire / Bank automate keyboard**
- . Marque / Trade mark : **INGENICO**
- . Constructeur / Manufacturer : **INGENICO**
- . Type / Model : **IUP250**
- . N° de série / serial number : **PROTO**
- . FCC ID : **XKB-IUP250-WD**

Date des essais / Test date : Du 8 au 28 Février 2012 / *From February 8th to 28th, 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 : Jonathan PAUC

Ce document comporte / Composition of document : 17 pages.

Ecrit par / *Written by*,
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MOIRANS, LE 19 JUILLET 2012 / *JULY 19TH, 2012*

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SUMMARY

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1. TEST PROGRAM

Standard: - FCC Part 15, Subpart B (Digital Devices)
 - ANSI C63.4 (2003)

| EMISSION TEST | LIMITS | | | RESULTS (Comments) |
|---|--|--------------------------------|-----------------------------|--------------------|
| Limits for conducted disturbance at mains ports 150kHz-30MHz | Frequency | Quasi-peak value (dBµV) | Average value (dBµV) | COMPLY |
| | 150-500kHz | 66 to 56 | 56 to 46 | |
| | 0.5-5MHz | 56 | 46 | |
| | 5-30MHz | 60 | 50 | |
| Radiated emissions 30MHz-12.5GHz* | Measure at 3m 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m | | | COMPLY |

*§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.



2. SYSTEM TEST CONFIGURATION

2.1. JUSTIFICATION

The system was configured for testing in a typical fashion (as a customer would normally use it).

The equipment IUP250 can be used with several internal option cards:

- COM2 + MDB Configuration n°2
- COM2 + MDB + GPRS modular approval Configuration n°3

The Equipment Under Test will be the configuration n°3 to represent others configurations (Worst case) IUP250 has to be integrated in unattended devices. The test configuration is given by the manufacturer

2.2. HARDWARE IDENTIFICATION

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

IUP250

Serial number: PROTO

FCC ID: XKB-IUP250-WD

Internal max frequencies: 400MHz

- **Modular Approval contained:**

- 1 x GPRS module, SAGEMCOM , HILO V2 INGENICO, FCC ID: VW3HILOV2

- **Power supply: 12-30Vdc**

EUT is not sold with any power supply, an AC/DC power supply adapter is used to provide **12VDC (worst case)** during whole tests.(worst case)

- **Input/output:**

- 1 x MDB slave port "DC power input (12-30VDC)"
- 2 x Serial link (COM0 & COM 2)
- 1 x Ethernet line
- 1 x USB port (Slave)
- 4 x USB ports (Host)
- 1 x MDB Master (4 wires). "
- 1 x 5V output port

- 2 x SAMs slot
- 1 x SIM slot
- 1 x MicroSD slot
- 1 x SMA connector, (GSM)

- **Cables/Accessories:**

- 1 x AC power cord, 2 wires, unshielded: 2m
- 1 x DC power supply cable (fixed on mains power unit), unshielded: 1.75m
- 1 x Ethernet cable Type: STP Cat 5e, shielded: 2m
- 5 x USB cables, shielded, (4 x spiraled: 1m & 1x non spiraled: 1m)
- 2 x RS232 Com cables, RJ11, unshielded, 1.5 m (COM 0 & Com 2)
- 1 x MdB-slave '6 pins' <-> MdB- master '8 pins' cable, unshielded
- 1 x Jack cable , unshielded, length: 0.3cm
- 1 x GPRS Antenna type, length: 200cm

• **Auxiliaries equipment used during test:**

- 1 x Laptop TOSHIBA SATELLITE PS141E-04YC sn : 13594938G
- 1 x AC/DC Power supply adapter PHIHONG PSM36W-120TW, 100-240VAC / 1.5A / 50-60Hz, output 12VDC / 3A

• **Functions:**

- 1 x SAM card reader
- 1 x Serial link communication (COM0 & COM2)
- 1 x μ SD card reader (SAM1 & SAM2)

2.3. EUT CONFIGURATION

A generic program test is loaded on EUT, in order to perform in loop following functions:

- Reading / writing SAM card (SAM1 & SAM2)
- Reading / writing μ SD card (MMC)
- Continuous loop communication From RX/TX on Serial port (COM0 & COM2)
- Continuous Ethernet communication is performed from EUT to Laptop (Ping)

2.4. EQUIPMENT MODIFICATIONS

A ferrite (integrated secondary power supply PHIHONG PSM36W-120TW) is set on two wires which provided 12Vdc (MDm slave connector side).

A ferrite type WE 74271222(Two turns) is set on others MdBm slave wires



2.5. SPECIAL ACCESSORIES

None



3. CONDUCTED EMISSION DATA

3.1. CLIMATIC CONDITIONS

Date of test : February 28th, 2012
Test performed by : J.PAUC
Atmospheric pressure : 1001 mb
Relative humidity : 30%
Ambient temperature : 22°C

3.2. SETUP FOR CONDUCTED EMISSIONS MEASUREMENT

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

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

3.3. 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.

Auxiliaries are powered by another LISN.

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



Conducted emission test setup

3.4. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE |
|----------------------------------|-----------------|---------|----------|
| Cable | - | - | A5329198 |
| Direct Injection Module 100 Ohms | LUTHI | CR100A | A7156004 |
| LISN | RHODE & SCHWARZ | ENV216 | C2320123 |
| Receiver 20Hz – 8GHz | ROHDE & SCHWARZ | ESU8 | A2642019 |
| Thermo-hygrometer | HUGER | - | B4204052 |
| Attenuator 10dB | RHODE & SCHWARZ | ESH3-Z2 | A7122204 |

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

3.6. 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 L: graph Emc#1

(see annex 1)

Measure on N: graph Emc#1

(see annex 1)

RESULT: PASS

4. RADIATED EMISSION DATA

4.1. CLIMATIC CONDITIONS

| | | |
|----------------------|-----------------------------------|----------------------------------|
| Date of test | : February 8 th , 2012 | February 15 th , 2012 |
| Test performed by | : J.PAUC / A.MERLIN | J.PAUC / A.MERLIN |
| Atmospheric pressure | : 1002mB | 1000mB |
| Relative humidity | : 32% | 31% |
| Ambient temperature | : 21°C | 21°C |

4.2. 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.



Radiated emission test setup

4.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None



4.2. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE |
|----------------------------------|-----------------|------------|----------|
| Adapter quasi-peak | HEWLETT PACKARD | HP85650A | A4049060 |
| Amplifier 0.1MHz – 1300 MHz | HEWLETT PACKARD | 8447F | A7486006 |
| Amplifier 1-8GHz | HEROTEK | A1080304A | A7102024 |
| Antenna Bi-Log XWing | TESEQ | CBL6144 | C2040146 |
| Antenna Bi-lo | CHASE | CBL6111A | C2040051 |
| Antenna Horn | EMCO | 3115 | C2042027 |
| Cable | - | - | A5329045 |
| Cable | - | - | A5329056 |
| Cable | - | - | A5329057 |
| Cable | | | A5329089 |
| Cable | | | A5329083 |
| Cable | | | A5329061 |
| Cable OATS (Turn table) | UTIFLEX | | A5329187 |
| Cable OATS (Mast at 10m) | UTIFLEX | | A5329188 |
| Cable OATS (Mast at 10m) | UTIFLEX | | A5329199 |
| Radiated emission comb generator | BARDET | | A3169050 |
| Semi-Anechoic chamber #2 | SIEPEL | - | D3044015 |
| Semi-Anechoic chamber #1 | SIEPEL | | D3044016 |
| Spectrum analyzer display | HEWLETT PACKARD | HP85662A | A4060028 |
| Thermo-hygrometer | HUGER | - | B4204052 |
| Turntable controller (Cage#2-3) | ETS Lingren | Model 2066 | F2000393 |
| Table | LCIE | - | F2000438 |
| Receiver 20Hz – 8GHz | ROHDE & SCHWARZ | ESU8 | A2642019 |
| OATS | | | F2000409 |



4.3.4. Characterization on 10 meters open site from 30MHz to 2GHz

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 . Measurement bandwidth was 120kHz from 30 MHz to 1GHz and 1MHz from 1GHz to 2GHz. 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 clause 2.3

Worst case final data result:

| No | Frequency (MHz) | QPeak Limit (dBµV/m) | Qpeak * (dBµV/m) | Qpeak-Limit (Margin, dB) | Angle (deg) | Pol | Hgt (cm) | Tot Corr (dB) |
|----|-----------------|----------------------|------------------|--------------------------|-------------|-----|----------|---------------|
| 1 | 35.134 | 40 | 34.8 | -5.2 | 154 | V | 100 | 15.3 |
| 2 | 60.202 | 40 | 33.9 | -6.1 | 210 | V | 150 | 6.5 |
| 3 | 193.528 | 43.5 | 39.9 | -3.6 | 200 | V | 200 | 12 |
| 4 | 241.839 | 46 | 39.2 | -6.8 | 310 | H | 100 | 14.7 |
| 5 | 249.999 | 46 | 33.5 | -12.5 | 252 | H | 250 | 15.2 |
| 6 | 324.879 | 46 | 32.5 | -13.5 | 158 | V | 150 | 17 |
| 7 | 387.127 | 46 | 42.9 | -3.1 | 281 | H | 150 | 18.9 |
| 8 | 483.676 | 46 | 38.1 | -7.9 | 310 | H | 200 | 21.2 |

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

Frequency band 1GHz to 2GHz

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

| No | Frequency (MHz) | Limit Peak @3m (dBµV/m) | Measure Peak @3m (dBµV/m) | Margin (Mes-Lim) (dB) | Angle Table (deg) | Pol Ant. | Ht Ant. (cm) | Correc. factor (dB) |
|----|-----------------|-------------------------|---------------------------|-----------------------|-------------------|----------|--------------|---------------------|
| 1 | 1.097.88 | 74 | 40.2 | -33.8 | 75 | V | 100 | 25.3 |
| 2 | 1.104.89 | 74 | 37.9 | -36.1 | 80 | V | 100 | 25.3 |
| 3 | 1.199.69 | 74 | 46.5 | -27.5 | 85 | V | 100 | 26.1 |
| 4 | 1.394.71 | 74 | 50 | -24.0 | 85 | V | 100 | 27.0 |
| 5 | 1.619.85 | 74 | 43 | -31.0 | 90 | V | 100 | 27.9 |

Note: Measures have been done at 3m distance.

| No | Frequency (MHz) | Limit Avg @3m (dBµV/m) | Measure Avg @3m (dBµV/m) | Margin (Mes-Lim) (dB) | Angle Table (deg) | Pol Ant. | Ht Ant. (cm) | Correc. factor (dB) |
|----|-----------------|------------------------|--------------------------|-----------------------|-------------------|----------|--------------|---------------------|
| 1 | 1097.88 | 54 | 30.0 | -24.0 | 75 | V | 100 | 25.3 |
| 2 | 1104.89 | 54 | 23.0 | -31.0 | 80 | V | 100 | 25.3 |
| 3 | 1199.69 | 54 | 35.3 | -18.7 | 85 | V | 100 | 26.1 |
| 4 | 1394.71 | 54 | 26.0 | -28.0 | 85 | V | 100 | 27.0 |
| 5 | 1619.85 | 54 | 37.0 | -17.0 | 90 | V | 100 | 27.9 |

Note: Measures have been done at 3m distance.

RESULTS: PASS



4.4. 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 μ 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 μ V/m.

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

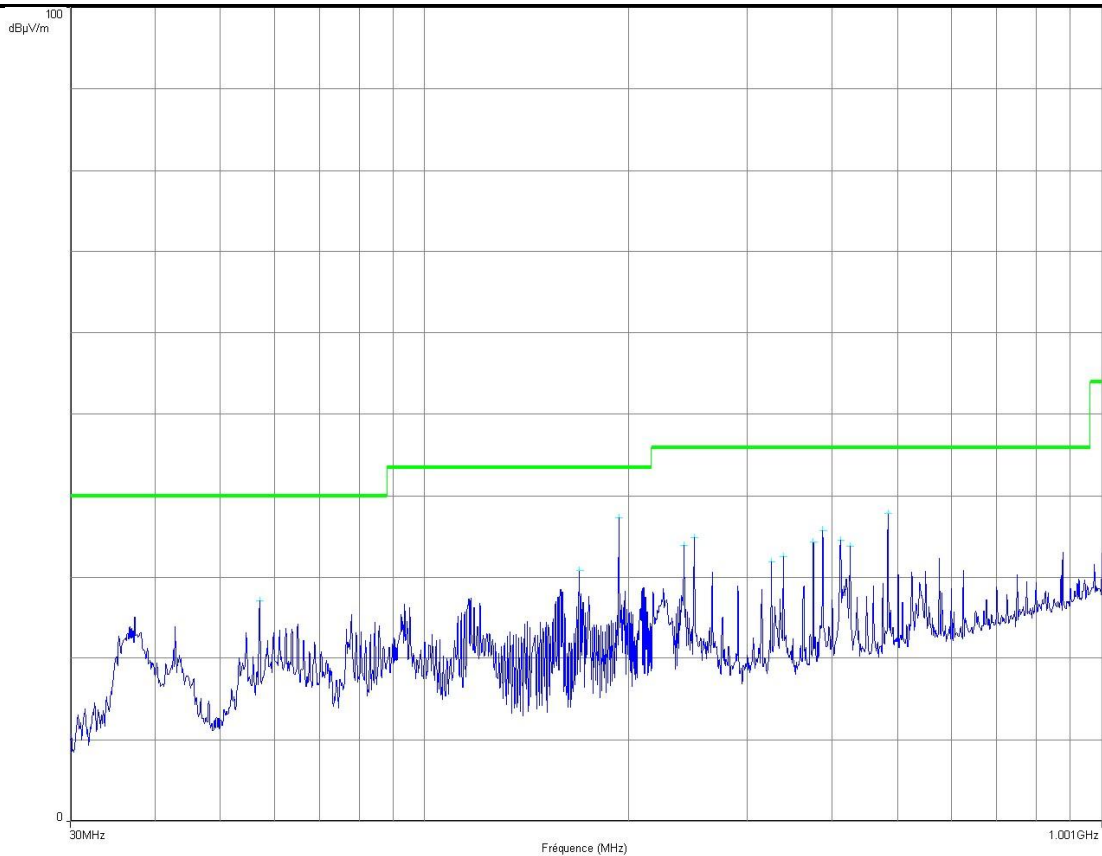
The 32 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

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



6. ANNEX 1 (GRAPHS)

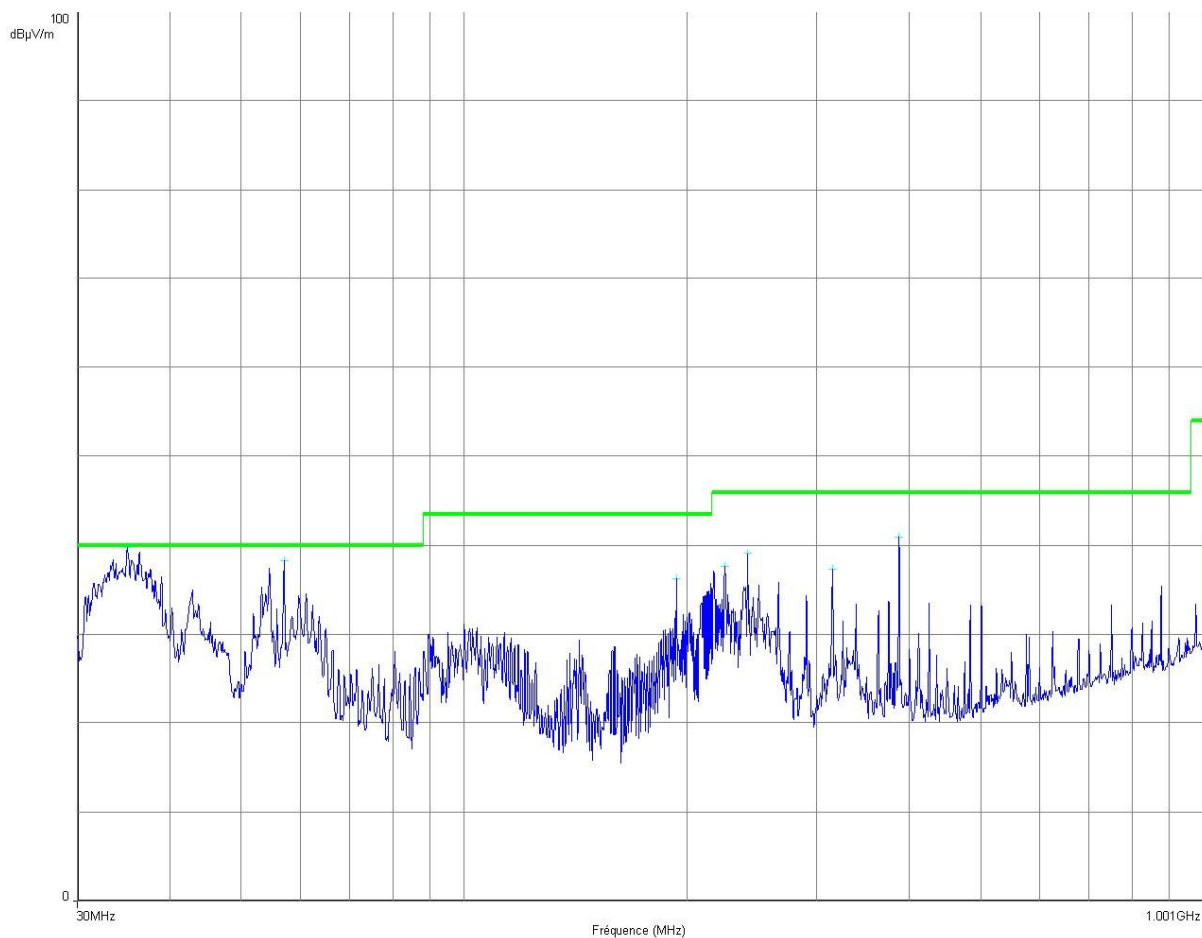
| RADIATED EMISSIONS | | |
|-----------------------|-----------------|---------------------|
| Graph name : | Emr#1 | Test configuration: |
| Limit : | FCC Part15 B | |
| Class : | B | |
| PARAMETERS | | |
| Antenna polarization: | Horizontale | Legend: |
| Azimuth : | 0° - 360° | Peak Measure |
| RBW : | 100kHz | |
| VBW : | 300kHz | QPeak Limit@3m |
| Frequency : | 30MHz- 1.001GHz | |



| Frequency (MHz) | Level (dBµV/m) |
|-----------------|----------------|
| 57.08 | 27.12 |
| 169.24 | 30.78 |
| 193.6 | 37.3 |
| 241.8 | 33.86 |
| 249.92 | 34.81 |
| 324.88 | 31.88 |
| 338.6 | 32.59 |
| 374.88 | 34.3 |
| 387 | 35.71 |
| 411.12 | 34.45 |
| 424.96 | 33.83 |
| 483.68 | 37.78 |



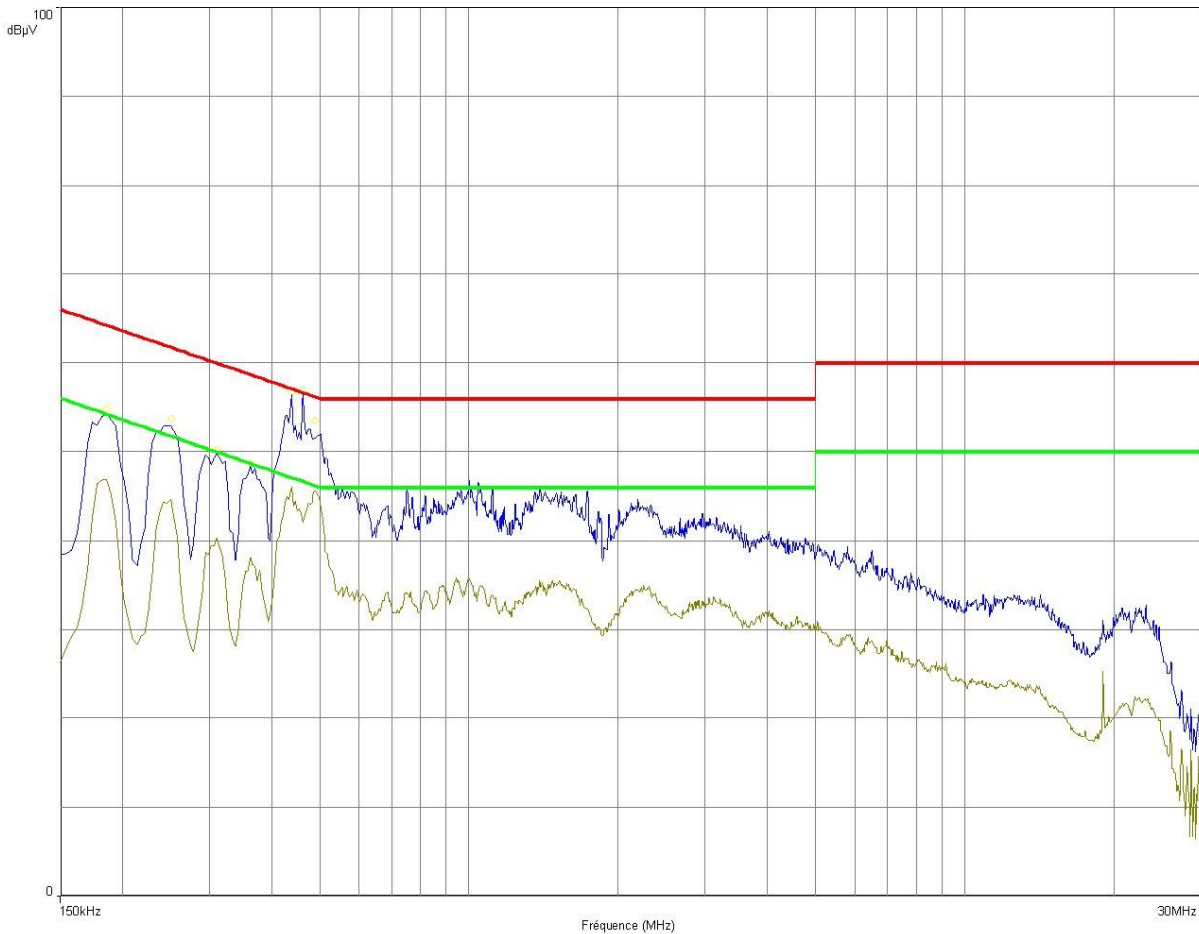
| RADIATED EMISSIONS | | |
|-----------------------|-----------------|---------------------|
| Graph name : | Emr#2 | Test configuration: |
| Limit : | FCC Part15 B | |
| Class : | B | |
| PARAMETERS | | |
| Antenna polarization: | Vertical | Legend: |
| Azimuth : | 0° - 360° | Peak Measure |
| RBW : | 100kHz | |
| VBW : | 300kHz | QPeak Limit@3m |
| Frequency : | 30MHz- 1.001GHz | |



| Frequency (MHz) | Level (dBµV/m) |
|-----------------|----------------|
| 35.04 | 39.77 |
| 57.04 | 38.21 |
| 193.6 | 36.3 |
| 224.96 | 37.57 |
| 241.84 | 39.06 |
| 314.52 | 37.32 |
| 387.04 | 40.91 |



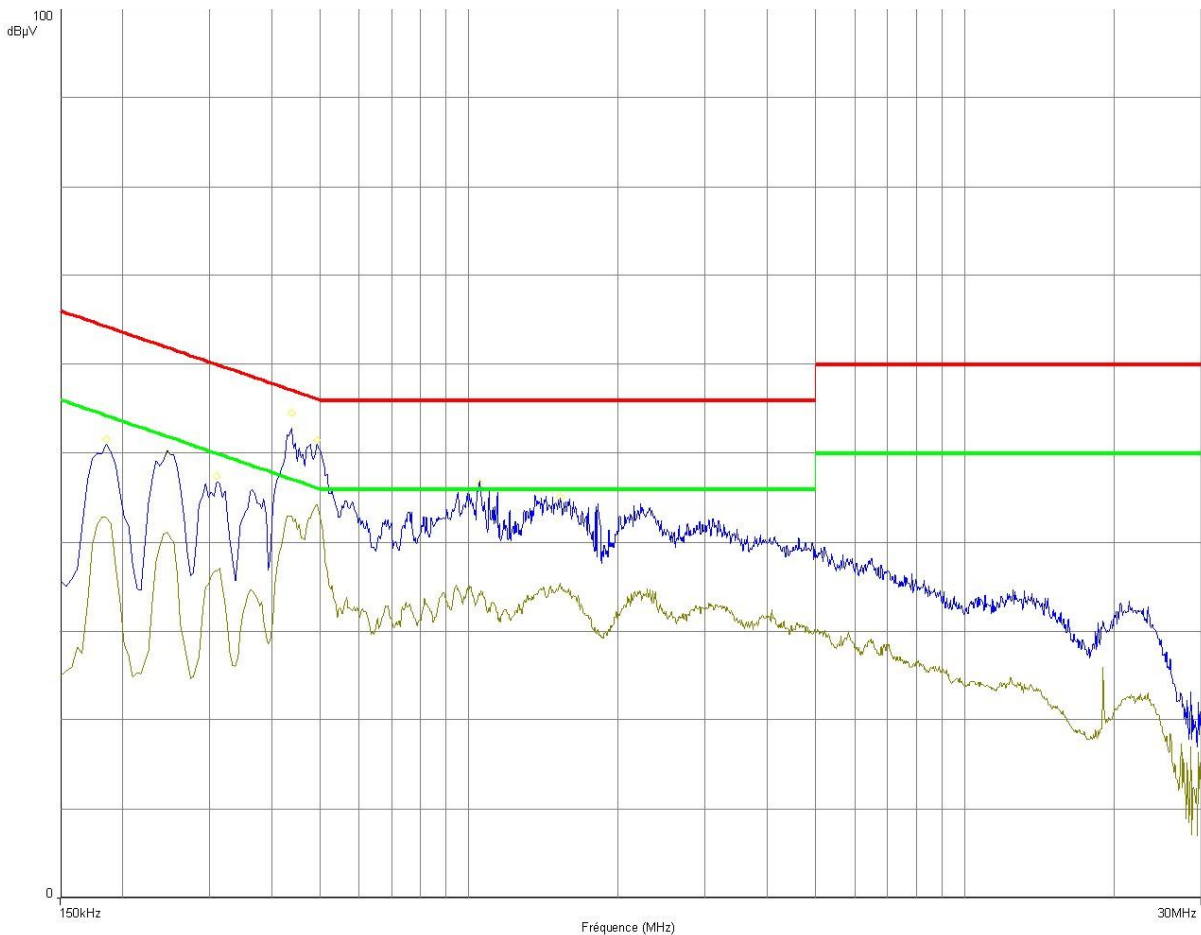
| CONDUCTED EMISSIONS | | | |
|-----------------------|---------------|---------------------|-----------------|
| Graph name : | Emc#1 | Test configuration: | |
| Limit : | FCC Part15 B | | |
| Class : | B | | |
| PARAMETERS | | | |
| Voltage / Frequency : | 120VAC / 60Hz | Legend: | |
| Line : | Phase | Peak Measure | Average Measure |
| RBW : | 9kHz | QPeak Limit | Average Limit |
| VBW : | 30kHz | | |
| Frequency : | 150kHz- 30MHz | | |



| Frequency (MHz) | Avg (dBµV) | Lim Avg (dBµV) | Avg-LimAvg (dBµV) | QPeak (dBµV) | LimQPeak (dBµV) | QPeak-LimQPeak (dBµV) |
|-----------------|------------|----------------|-------------------|--------------|-----------------|-----------------------|
| 0.186 | 46.66 | 54.21 | -7.55 | 52.01 | 64.21 | -12.21 |
| 0.25 | 44.1 | 51.76 | -7.66 | 51.15 | 61.76 | -10.6 |
| 0.31 | 39.82 | 49.97 | -10.15 | 47.57 | 59.97 | -12.4 |
| 0.362 | 37.37 | 48.68 | -11.31 | 45.86 | 58.68 | -12.82 |
| 0.438 | 44.91 | 47.1 | -2.19 | 51.96 | 57.1 | -5.14 |
| 0.462 | 42.51 | 46.66 | -4.14 | 49.26 | 56.66 | -7.4 |
| 0.49 | 45.58 | 46.17 | -0.59 | 49.37 | 56.17 | -6.8 |



| CONDUCTED EMISSIONS | | | |
|-----------------------|---------------|---------------------|-----------------|
| Graph name : | Emc#2 | Test configuration: | |
| Limit : | FCC Part15 B | | |
| Class : | B | | |
| PARAMETERS | | | |
| Voltage / Frequency : | 120VAC / 60Hz | Legend: | |
| Line : | Neutral | 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) |
|-----------------|------------|----------------|-------------------|--------------|-----------------|-----------------------|
| 0.186 | 42.63 | 54.21 | -11.58 | 48.28 | 64.21 | -15.94 |
| 0.246 | 40.97 | 51.89 | -10.92 | 47.06 | 61.89 | -14.83 |
| 0.31 | 36.92 | 49.97 | -13.05 | 44.36 | 59.97 | -15.61 |
| 0.438 | 42.84 | 47.1 | -4.26 | 49.1 | 57.1 | -8 |
| 0.494 | 44.15 | 46.1 | -1.95 | 48.51 | 56.1 | -7.59 |
| 1.05 | 33.73 | 46 | -12.27 | 41.47 | 56 | -14.53 |
| 1.526 | 35.07 | 46 | -10.93 | 41.55 | 56 | -14.45 |



7. 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.