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Rapport d'essai / *Test report*

JDE : 111847 **N°** 351728-R1-E

DELIVRE A / *ISSUED TO* : **INGENICO**
1, Rue Claude Chappe
BP 348
07503 GUILHERAND-GRANGES - France

Objet / *Subject* : Essais de compatibilité électromagnétique conformément aux normes :
Electromagnetic compatibility tests according to the standards:
FCC CFR 47 Part 15, Subpart B.
ANSI C63.4 (2003)

Matériel testé / *Apparatus under test* :

- Produit / *Product* : Lecteur de carte bancaire / *Bank payment terminal*
- Marque / *Trade mark* : **INGENICO**
- Constructeur / *Manufacturer* : **INGENICO**
- Type / *Model* : **ICT220-01T1217C**
- N° de série / *serial number* : **11017CT70563492**
- FCC ID : **XKB-ICT220**

Date des essais / *Test date* : *Les 18 et 19 Janvier 2012 / Jannuary 18th & 19th, 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* : Nathalie GAGNAIRE

document comporte / *Composition of document:* 17 pages

MOIRANS, LE 26 JANVIER 2012 / *JANUARY 26TH, 2012*

Ecrit par / *Written by*
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SUMMARY

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)**	**PASS**
	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			**PASS**

***§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. APPARATUS UNDER TEST: CONFIGURATION

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

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

ICT220-01T1217C **Serial Number: 11017CT70563492**

MagicBox: 2961105416

- **Power supply:**

- AC / DC Adaptor: PHIHONG Model N°: PSM24W-080 S n/4
- Rating: 100-240V
- Output : 8V DC 3A
- Frequency: 50-60Hz

- **Inputs/outputs:**

- 1x DC power input (8Vdc)
- 1x Serial link (RS232C can't be longer than 3m)
- 1x Ethernet line (may be longer than 3m)
- 1x Dial-up Modem line IN (may be longer than 3m)
- 1 x USB host, not used and without cable
- 1 x USB slave, not used and without cable
- 2 x SAMs
- 1 x CAM0
- 1 x MicroSD, not used.

- **Cables:**

- 1x Magic Box extension cord with I/O connectors, spiraled: 1m
- 1x AC power cord, 2 wires, unshielded: 2m
- 1x DC power supply cable (fixed on mains power unit), unshielded: 1.75m
- 1x Ethernet cable, Cat 5e, unshielded: 2m
- 1x RS232 Com cable, RJ11, unshielded, 1.5m
- 1x Line In cable, RJ11, unshielded, 1.5m

- **Auxiliaries equipment used during test:**

- 1x Smartcard (Bank credit card) Sn: none
- 2x SAM cards Sn: none
- 1x Laptop PC TOSHIBA SATELITE S1410-704 (PS141E-04YCM-3V) Sn: 13594938G
  with its power supply unit (PA3201U-1ACA SEB100P2-15.0)
- 1x TELTON Telephone line simulator TLS-5B-01 Sn: 014184

2.2. RUNNING MODE

The EUT is connected to a laptop PC with its Ethernet link. (Ping function activated).
The inboard software (TEST CEM) performed the followings tests and activates the followings functions:

- Printer ON,
- Modem is online
- Smartcards reading: CAM0, SAM1 and 2 (power ON and reading)
- Backlight and display are ON.

2.3. EQUIPMENT MODIFICATIONS

None

2.4. SPECIAL ACCESSORIES

None

3. MEASUREMENT OF CONDUCTED EMISSION (150KHZ-30MHZ)

3.1. TEST CONDITIONS

Date of test : January 18th, 2012
Test performed by : Nathalie GAGNAIRE
Atmospheric pressure : 1010hPa
Relative humidity : 30%
Ambient temperature : 21℃

3.2. SETUP FOR CONDUCTED EMISSIONS MEASUREMENT

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

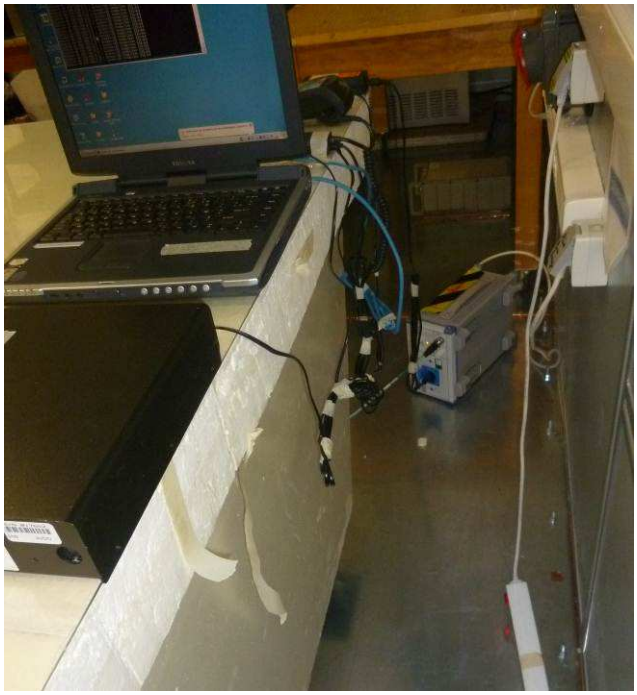
The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 subpart B §15.107 limits. Measurement bandwidth was 9kHz from 150 kHz to 30 MHz.

The EUT with its auxiliaries are set on a non-conducting table 80cm above the ground reference plane.
The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane.
The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.

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 and auxiliaries) 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 EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N°LCIE
Conducted emission comb generator	BARDET	-	A3169049
LISN tri-phase ESH2-Z5	RHODE & SCHWARZ	33852.19.53	C2320063
LISN	RHODE & SCHWARZ	ENV216	C2320123
Cable	-	-	A5329197
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Thermo-hygrometer	OREGON	BAR916HG-G	B4206011
Transient limiter	ROHDE & SCHWARZ	ESH3-Z2	A4049204

3.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

3.5. MEASUREMENTS RESULTS

Mains terminals 110Vac/60Hz:

Measurements are performed on the phase (L1) and neutral (N) of the power line of the EUT.

Measure on L1: graph **Emc#1** (see annex 1)
Measure on N: graph **Emc#2** (see annex 1)

RESULT: PASS

4. MEASUREMENT OF RADIATED EMISSION (30MHZ-12.5GHZ)

4.1. TEST CONDITIONS

Date of test : January 18th & 19th, 2012
Test performed by : Nathalie GAGNAIRE
Atmospheric pressure : 1010hPa
Relative humidity : 30%
Ambient temperature : 21°C

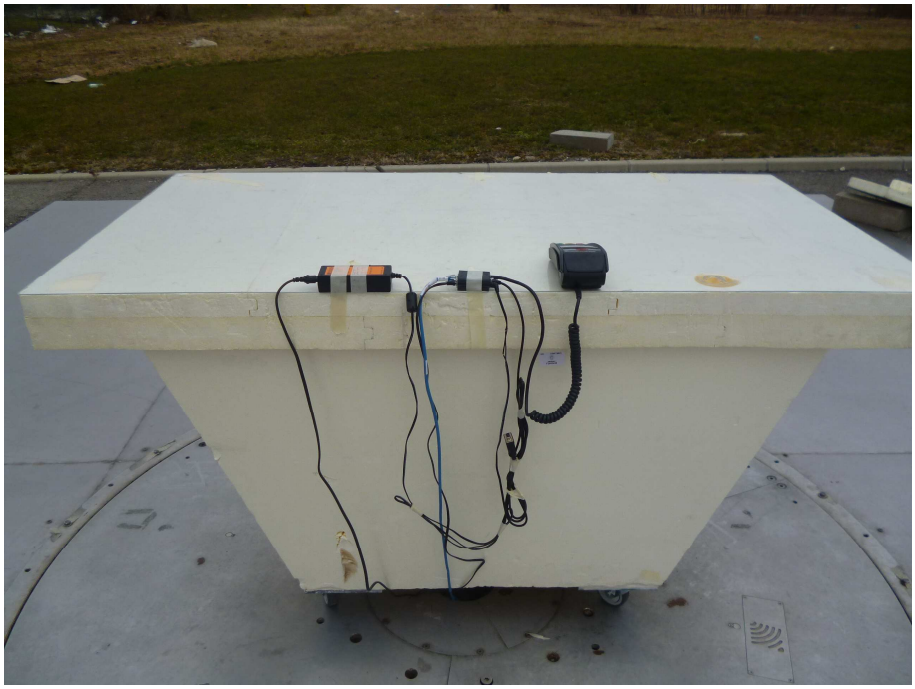
4.2. SETUP FOR RADIATED EMISSIONS MEASUREMENT

The installation of EUT is identical for pre-characterization measures in a 3 meters semi-anechoic chamber and for measures on the 10 meters Open site.
The EUT and auxiliaries are set on the non-conducting table of 80 cm height.
The EUT is powered by 230Vac/50Hz (EUT and auxiliaries)

Pre-characterisation measurement:
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. During the measurement, the EUT is rotated on a 360° range.
The pre-characterization graphs are obtained in PEAK detection.
For frequency band 1GHz to 12.5GHz, a search is performed in the semi-anechoic chamber in order to determine frequencies radiated by the EUT (Measuring distance reduced to 1m).

Characterization on 10 meters open site from 30MHz to 1GHz:
The product has been tested according to ANSI C63.4 (2003), FCC part 15 subpart B. 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** (30MHz to 1GHz) and **3 meters** (1GHz to 12.5GHz) from the antenna and corrected according to requirements of 15.109.e).
Results are 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 12.5GHz.
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.



4.3. 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 8-26GHz	ALDETEC	ALS01452	A7102026
Antenna horn	EMCO	3115	C2042027
Antenna Bi-Log XWing	TESEQ	CBL6144	C2040146
Antenna horn	EMCO	3115	C2042027
Cable	-	-	A5329045
Cable	-	-	A5329056
Cable	-	-	A5329057
Semi-Anechoic chamber #2	SIEPEL	-	D3044015
Radiated emission comb generator	BARDET	-	A3169050
Spectrum analyzer display	HEWLETT PACKARD	HP85662A	A4060028
Spectrum analyzer	HEWLETT PACKARD	HP8568B	A4060029
Thermo-hygrometer	OREGON	BAR916HG-G	B4206011
Turntable controller (Cage#2-3)	ETS Lingren	Model 2066	F2000393
Antenna Bi-log	CHASE	CBL6111A	C2040051
Cable	-	-	A5329557
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329188
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329199
Radiated emission comb generator	BARDET	-	A3169050
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Thermo-hygrometer	OREGON	BAR916HG-G	B4206011
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403

4.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

4.5. MEASUREMENTS RESULTS

Pre-characterisation measurement: pre-scan measurement at 3m (PEAK detection, graph examples)

Polarisation V: graph **Emr#1** (see annex 1)
Polarisation H: graph **Emr#2** (see annex 1)

QUALIFICATION: 10 / 3 meters measurement on the Open Area Test Site.

Frequency list has been created with semi-anechoic chamber pre-scan results.
Measurements are performed using a QUASI-PEAK detection.

Frequency range 30MHz to 1GHz:
Measurements are performed using a QUASI-PEAK detection (RBW=120kHz)

No	Frequency (MHz)	Limit Quasi-Peak (dBµV/m)	Measure Quasi-Peak (dBµV/m)	Margin (Meas-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	34,636	40,0	38,4	-1,6	0	V	100	15,5	
2	43,769	40,0	37,7	-2,3	80	V	100	11,8	
3	45,779	40,0	38,5	-1,5	100	V	100	10,9	
4	47,034	40,0	34,3	-5,7	54	V	100	10,3	
5	47,798	40,0	39,7	-0,3	0	V	100	9,8	
6	54,764	40,0	31,8	-8,2	85	V	100	7,7	
7	86,055	40,0	31,8	-8,2	56	V	100	9,6	
8	124,999	43,5	40,2	-3,3	138	V	100	14,7	
9	147,459	43,5	36,0	-7,5	105	V	100	13,6	
10	245,765	46,0	38,0	-8,0	0	V	100	15,0	

Note: Measures have been done at 10m distance and corrected according to requirements of 15.109.e) (M@3m = M@10m+10.5dB)

Frequency range 1GHz to 12.5GHz:
Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

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

No Significant Frequency Observed

RESULT: PASS

4.6. 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 52.5dBµV is obtained. The antenna factor of 7.4 and a cable factor of 1.1 is added. The amplifier gain of 29dB is subtracted, giving field strength of 32 dBµV/m.
FS = 52.5 + 7.4 + 1.1 – 29 = 32 dBµV/m
The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.
Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

5. UNCERTAINTIES CHART

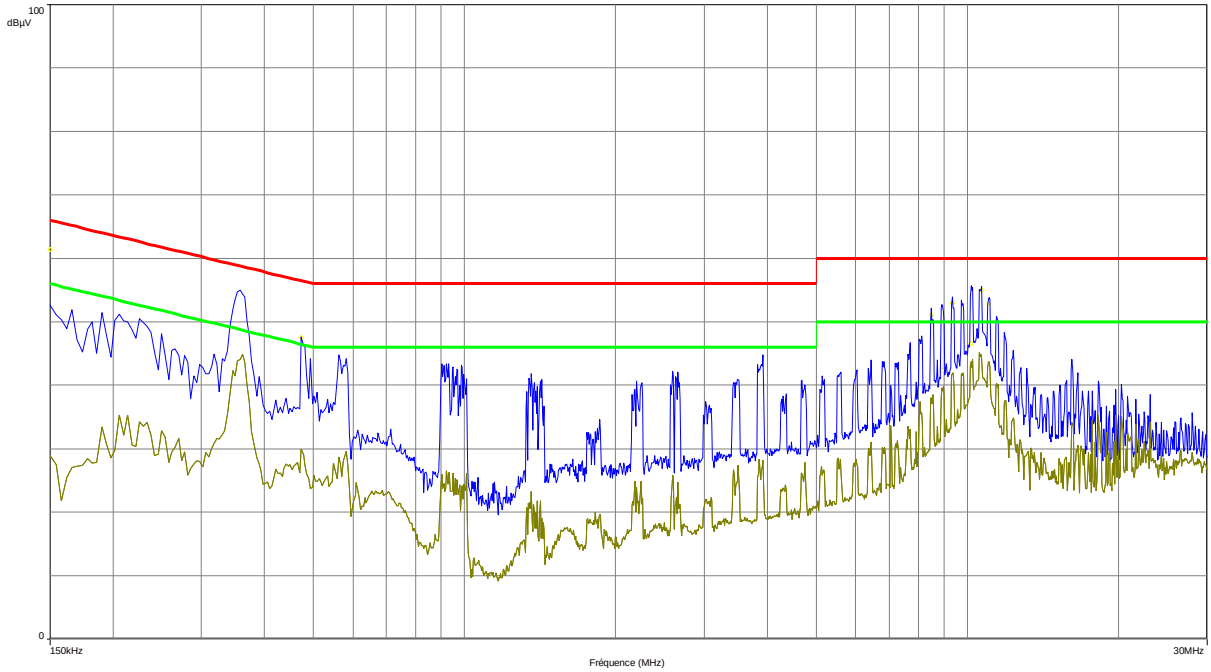
Type de mesure / *Kind of measurement*	**Incertitude élargie laboratoire / *Wide uncertainty laboratory* (k=2) ± x**	**Incertitude limite du CISPR / *CISPR uncertainty limit* ± y**
Mesure des perturbations conduites en tension sur le réseau d'énergie (triphasé) *Measurement of conducted disturbances in voltage on the power port (three phases)*	3.6 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau d'énergie (monophasé) *Measurement of conducted disturbances in voltage on the power port (single line)*	3.57 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication *Measurement of conducted disturbances in voltage on the telecommunication port.*	3.28 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension *Measurement of discontinuous conducted disturbances in voltage*	3.47 dB	3.6 dB
Mesure des perturbations conduites en courant *Measurement of conducted disturbances in current*	2.90 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Moirans *Measurement of radiated electric field on the Moirans open area test site*	5.07 dB	5.2 dB
Mesure du champ électrique rayonné IN SITU de 30 à 1000 MHz *IN SITU measurement of radiated electric field from 30 to 1000MHz*	A l'étude / Under consideration	5.2 dB
Mesure de la puissance perturbatrice / *Measurement of disturbance power*	3.37 dB	4.5 dB
Mesure des harmoniques de courant / *Measurement of current harmonics*	11.11%	/
Mesure du flicker / *Flicker measurement*	9.26%	/

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par le CISPR, 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 CISPR. The conformity of the sample is directly established by the applicable limits values.*

Note - L'incertitude de mesure instrumentale est déterminée selon la CISPR 16-4-2. / *The instrumentation measurement uncertainty is determined according to CISPR16-4-2*

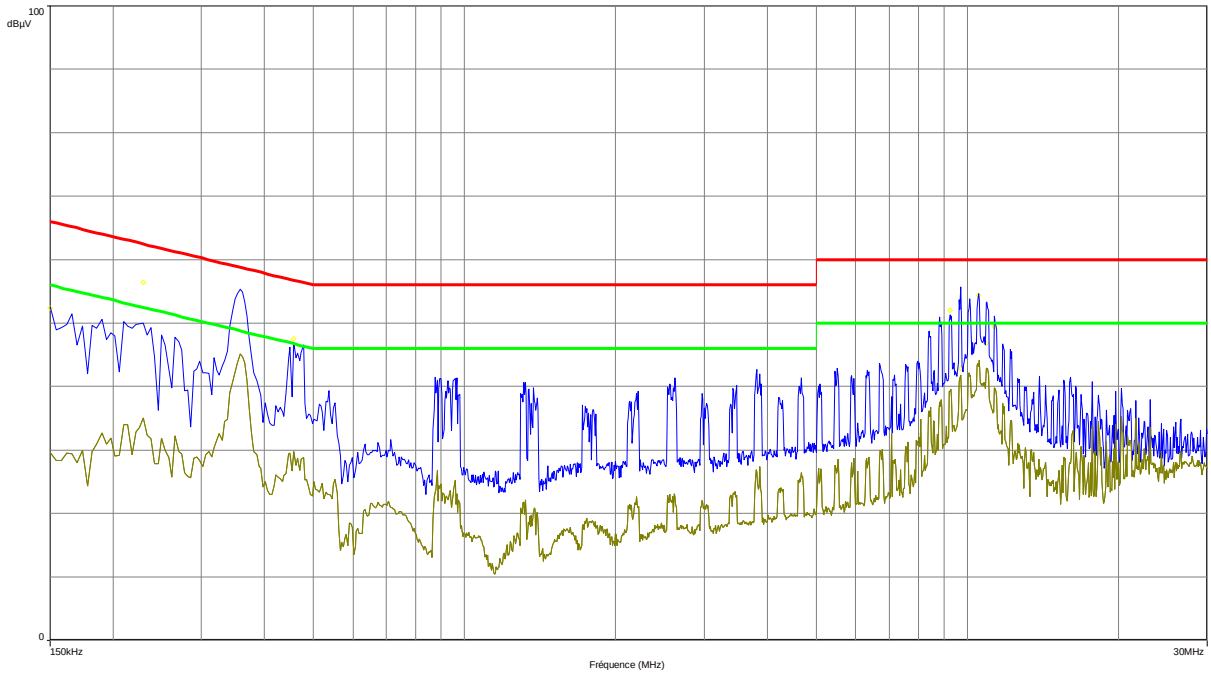
6. ANNEX 1 (GRAPHS)

CONDUCTED EMISSIONS					
Graph name :	Emc#1	**Test configuration:**			
Limit :	FCC Part 15B	ITC220 - L1 - 110V 60Hz			
Class :	B				
PARAMETERS					
Voltage / Frequency :	110VAC / 60Hz	**Legend:**			
Line :	Phase1		**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)
0.15	47.17	48.77	-1.6	53.74	58.77	-5.03
0.474	27.78	46.44	-18.66	38.54	56.44	-17.9
8.474	32.89	50	-17.11	43.23	60	-16.77
8.886	31.25	50	-18.75	39.69	60	-20.31
9.33	37.51	50	-12.49	45.56	60	-14.44
10.174	38.12	50	-11.88	48.44	60	-11.56
10.67	42.06	50	-7.94	48.34	60	-11.66
11.058	39.53	50	-10.47	47.44	60	-12.56

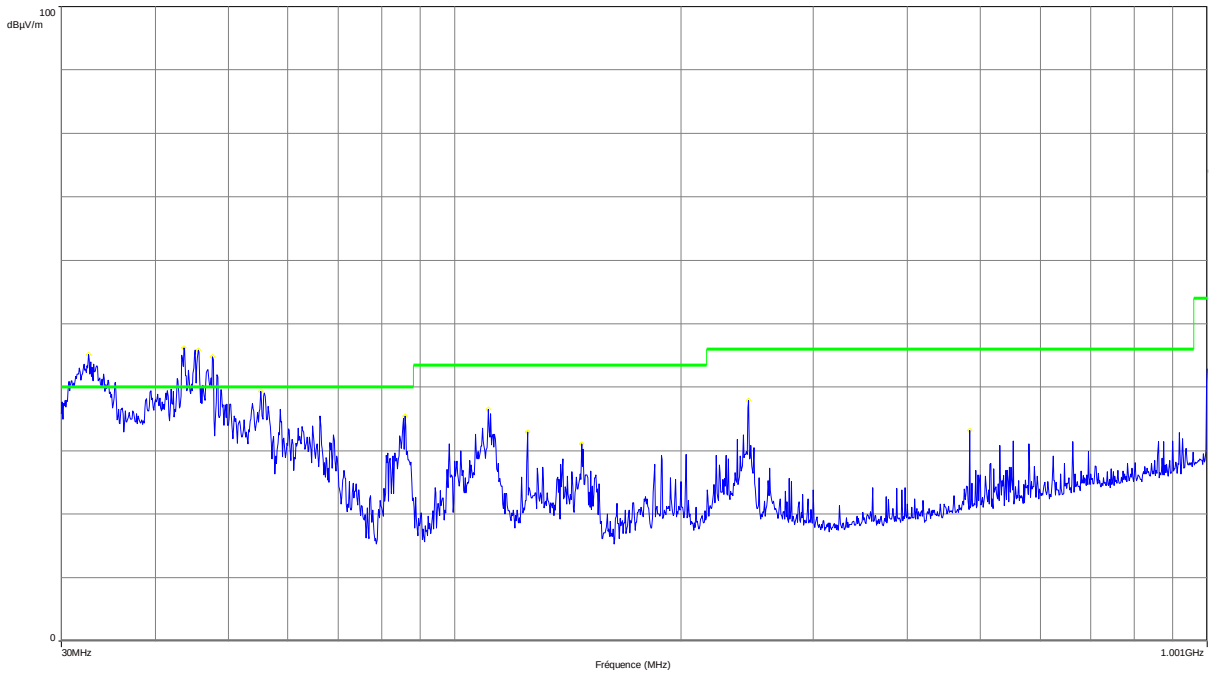
CONDUCTED EMISSIONS					
Graph name :	Emc#2	**Test configuration:**			
Limit :	FCC Part 15B	ITC220 - N - 110V 60Hz			
Class :	B				
PARAMETERS					
Voltage / Frequency :	110VAC / 60Hz	**Legend:**			
Line :	Neutral		**Peak Measure**		**Average Measure**
RBW :	9kHz				
VBW :	30kHz		**QPeak Limit**		**Average Limit**
Frequency :	150kHz- 30MHz				



Frequency (MHz)	Avg (dBµV)	Lim Avg (dBµV)	Avg-LimAvg (dBµV)	QPeak (dBµV)	LimQPeak (dBµV)	QPeak-LimQPeak (dBµV)
0.15	44.48	48.77	-4.3	52.65	58.77	-6.12
0.23	32.86	52.45	-19.59	47.88	62.45	-14.57
0.458	26.84	46.73	-19.89	39.89	56.73	-16.84
9.234	33.64	50	-16.36	44.28	60	-15.72
9.706	33.96	50	-16.04	40.52	60	-19.48
10.518	41.51	50	-8.49	48.29	60	-11.71
10.898	38.94	50	-11.06	47.11	60	-12.89
11.322	35.66	50	-14.34	41.82	60	-18.18

RADIATED EMISSIONS		
Graph name :	Emr#1	**Test configuration:**
Limit :	FCC Part15B	V - ITC220 V2
Class :	B	

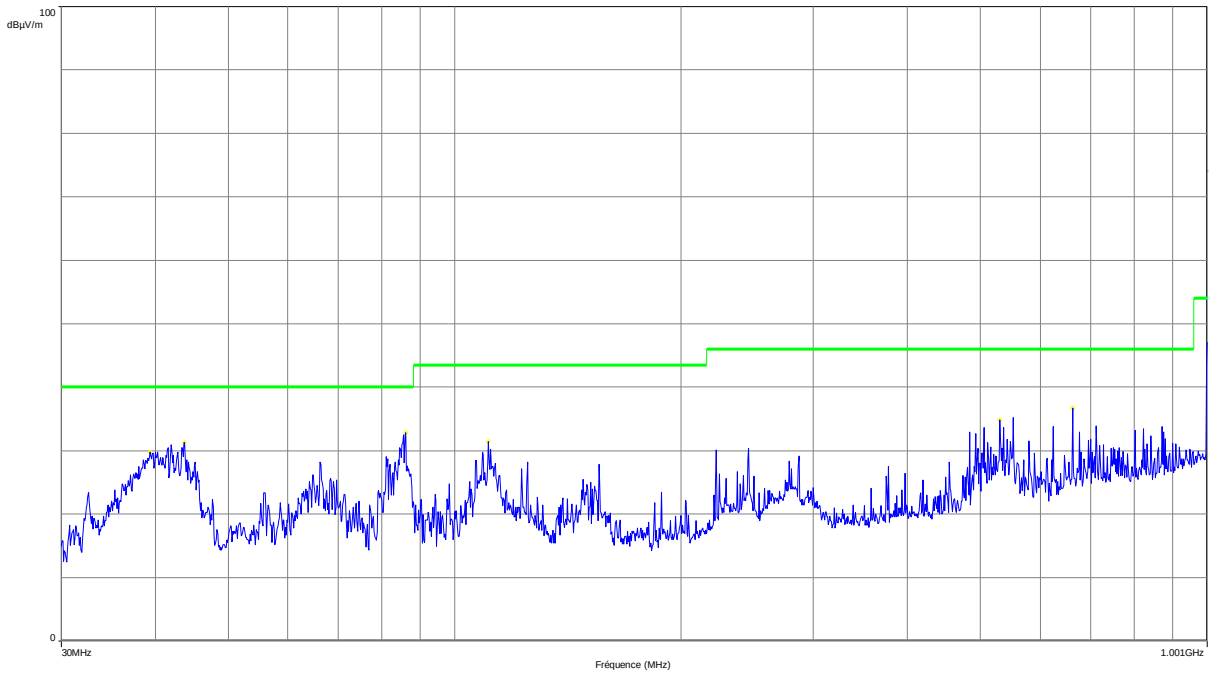
PARAMETERS			
Antenna polarization:	Verticale	**Legend:**	
Azimuth :	0°- 360°		**Peak Measure**
RBW :	100kHz		
VBW :	300kHz		**QPeak Limit@3m**
Frequency :	30MHz- 1.001GHz		



Freq (MHz)	Peak Level (dBµV/m)
32.6	45.09
43.68	46.21
45.6	45.84
47.68	44.73
55.2	39.34
85.96	35.43
110.96	36.53
124.88	32.96
147.48	31.06
245.68	37.88
483.72	33.18

RADIATED EMISSIONS		
Graph name :	Emr#2	**Test configuration:**
Limit :	FCC Part15B	H - ITC220 V2
Class :	B	

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



Freq (MHz)	Peak Level (dBµV/m)
39.36	29.77
43.72	31.31
86	32.83
110.88	31.42
530.64	34.79
663.52	36.75