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TEST REPORT

Portée disponible sur www.cofrac.fr

Laboratoire d'essai accrédité N°1-1633

N°: 852197-R1-E **JDE : 137077**

Subject **Electromagnetic compatibility tests according to the standards:**
FCC CFR 47 Part 15, Subpart B.
ANSI C63.4 (2003)

Issued to	**INGENICO** Rovaltain TGV – Le Valvert 9 avenue de la gare 26300 ALIXAN
Apparatus under test	
Product	**ISMP3 Intelligent Docking Station**
Trade mark	**INGENICO**
Manufacturer	**INGENICO**
Model under test	**IMP400-01B3145A**
Serial number	**15124KT00004452**
FCCID	**XKB-IMP403**
IC Test site	6500A-1 & 6500A-3
Test location	Moirans
Test performed by	Nathalie BUGANZA
Composition of document	19 pages
Last version	None
Document issued on	August 17th, 2015

Written by :
Nathalie BUGANZA
Tests operator

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Approved by :
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SUMMARY

1. TEST PROGRAM

1.1. REQUIREMENTS FOR DISTURBANCE EMISSIONS

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**	**Average value**	☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
	150-500kHz	66.0 dBµV to 56.0 dBµV	56.0 dBµV to 46.0 dBµV	
	0.5-5MHz	56.0 dBµV	46.0 dBµV	
	5-30MHz	60.0 dBµV	50.0 dBµV	
Radiated emissions 30MHz-1GHz	**Frequency**	**Quasi-peak value @3m**		☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
	30MHz-88MHz	40.0 dBµV/m		
	88MHz-216MHz	43.5 dBµV/m		
	216MHz-960MHz	46.0 dBµV/m		
	Above 960MHz	54.0 dBµV/m		
Radiated emissions 1GHz-2GHz* ***Highest frequency : 387MHz (Declaration of provider)***	**Frequency**	**Peak value @3m**	**Average value @3m**	☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
	1-2GHz	74.0 dBµV/m	54.0 dBµV/m	

***§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. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. INFORMATIONS

All tests are performed on the product with 6 (six) ISMP3+iPhone which is the full options product.

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
IMP400-01B3145A **Serial Number: 15124KT00004452**

Equipment Under Test

Power supply:
For radiated emeission test, EUT was powered by 230V/50Hz.
For conducted emeission test, EUT was powered by 110V/60Hz.

Name	Type	Rating	Reference / Sn	Comments
Supply	☑ AC ☐ DC ☐ Battery	100-240V 50/60Hz	Mean Well Model GS90A12-R7BBM1	Sn: EB4BC71608

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply	AC/DC adaptor	2	☑	☐	☑	
LAN1	RJ45	1	☐	☑	☑	
LAN2	RJ45	1	☐	☑	☑	
USB	USB	-	☐	☐	☐	Only for maintenance

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Laptop	TOSHIBA1	-	-
Laptop	DELL	-	-
ISMP3	IMP550-11T3104A	15202PP00008580	-
IPhone	MG472ZD/A	F17NQWDAG5MN	-
ISMP3	IMP550-11T3104A	15202PP00008512	-
IPhone	MG472ZD/A	C39NW3TAG5MN	-
ISMP3	IMP550-11T3104A	99999PP99999925	-
IPhone	MG472ZD/A	C7JPHCH5G5MN	-
ISMP3	IMP550-11T3104A	99999PP99999930	-
IPhone	MG472ZD/A	C7JPH2MMG5MN	-
ISMP3	IMP550-11T3104A	15202PP00008549	-
IPhone	MG472ZD/A	C5FPG1KEG5MN	-
ISMP3	IMP550-11T3104A	99999PP99999932	-
IPhone	MG472ZD/A	C7JPHC07G5MN	-

2.3. EUT CONFIGURATION – RUNNING MODE

Hardware version : IMP400-01B3145A, UC Board rev5, Slot board rev1
Software version : MC201B

The EUT is connected to 2 laptop PC with its Ethernet link. (Ping function activated).
6 Auxiliaries are installed to be charged

2.4. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

2.5. SPECIAL ACCESSORIES

None

2.6. 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.

3. MEASUREMENT OF CONDUCTED EMISSION

3.1. ENVIRONMENTAL CONDITIONS

Date of test	:	August 13th, 2015
Test performed by	:	Nathalie BUGANZA
Atmospheric pressure (hPa)	:	995
Relative humidity (%)	:	60
Ambient temperature (°C)	:	24

3.2. TEST SETUP

Mains terminals

The EUT and auxiliaries are set:

☑ 80cm above the ground on the non-conducting table (Table-top equipment)

☐ 10cm above the ground on isolating support (Floor standing equipment)

The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane.

The EUT is powered by V_{nom}.

The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.

Test setup

Test setup

3.3. TEST METHOD

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. Measurement bandwidth was 9kHz from 150kHz to 30MHz. 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.

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.

3.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + self	-	-	A5329585	06/15	06/16
Conducted emission comb generator	BARDET	-	A3169049	-	-
LISN tri-phase ESH2-Z5	RHODE & SCHWARZ	33852.19.53	C2320063	11/14	11/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	04/15	04/16
Thermo-hygrometer	KIMO	HQ210	B4206022	06/15	06/16
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204	11/14	11/15

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

3.6. TEST RESULTS

Mains terminals:

Supply
Measurements are performed on the phase (L1) and neutral (N) of the power line.
Results: (PEAK detection)

Graph identifier	Line	Comments	
Emc# 1	Phase	-	See annex 1
Emc# 2	Neutral	-	See annex 1

3.7. CONCLUSION

The sample of the equipment **IMP400-01B3145A**, Sn: **15124KT00004452**, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part15B, for conducted emissions.

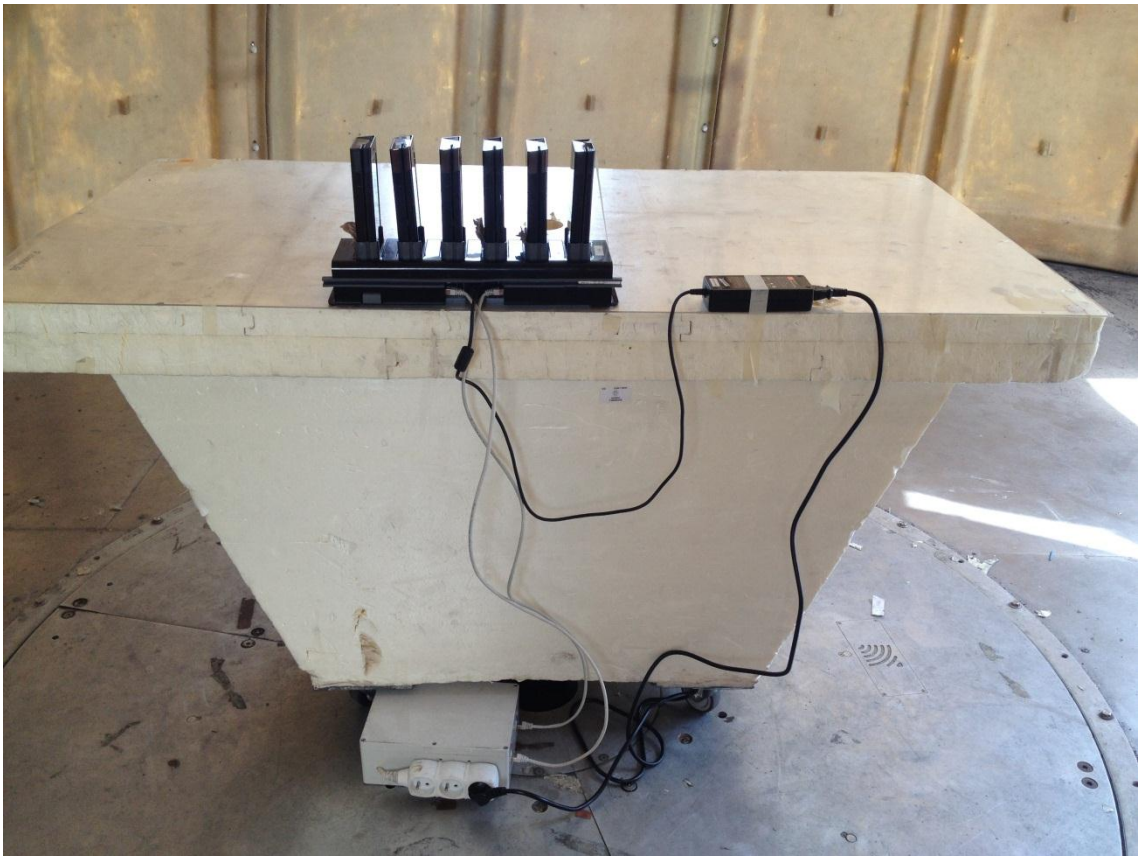
4. MEASUREMENT OF RADIATED EMISSION (30MHZ-2GHZ)

4.1. ENVIRONMENTAL CONDITIONS

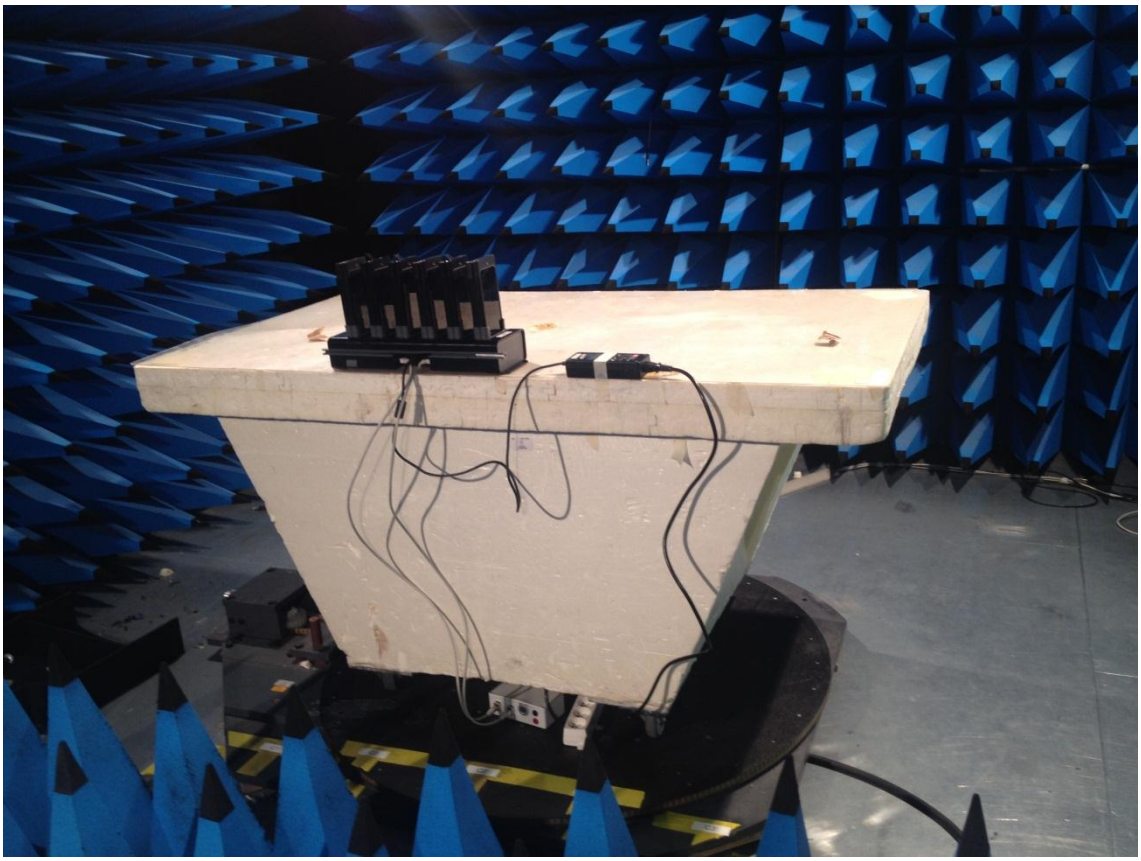
Date of test	:	August 13th, 2015
Test performed by	:	Nathalie BUGANZA
Atmospheric pressure (hPa)	:	995
Relative humidity (%)	:	60
Ambient temperature (°C)	:	24

4.2. TEST SETUP

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:
☑ 80cm above the ground on the non-conducting table (Table-top equipment)
☐ 10cm above the ground on isolating support (Floor standing equipment)
The EUT is powered by V_{nom}.



Test setup on OATS



Test setup in anechoic chamber

4.3. TEST METHOD

Pre-characterisation measurement: (30MHz –2GHz)
A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz to 2GHz. Test is performed in horizontal (H) and vertical (V) polarization during the test for maximized the emission measurement. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration.
The pre-characterization graphs are obtained in PEAK detection and PEAK/AVERAGE from 1GHz to 2GHz.

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** from the antenna and compared to the FCC part 15 subpart B §15.109 limits. Measurement bandwidth was 120kHz from 30 MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, during the test for maximized the emission measurement. The height antenna is varied from 1m to 4m. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.
Frequency list has been created with anechoic chamber pre-scan results.

Characterization on 3 meters full anechoic chamber from 1GHz to 2GHz:
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. Measurement bandwidth was 1MHz from 1GHz to 2GHz.
Test is performed in horizontal (H) and vertical (V) polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.The height antenna is
☐ On mast, varied from 1m to 4m
☒ Fixed and centered on the EUT
Frequency list has been created with anechoic chamber pre-scan results.

4.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447D	A7085009	10/14	10/15
Antenna Bi-Log XWing	TESEQ	CBL6144	C2040146	11/14	11/16
Antenna horn	EMCO	3115	C2042027	09/14	09/15
Emission Cable	MICRO-COAX	6GHz	A5329654	04/15	04/16
Emission Cable	MICRO-COAX	6GHz	A5329655	04/15	04/16
Emission Cable	MICRO-COAX	6GHz	A5329656	04/15	04/16
Semi-Anechoic chamber #2	SIEPEL	-	D3044015	03/15	03/16
Radiated emission comb generator	BARDET	-	A3169050	-	-
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088	-	-
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642049	11/14	11/15
Thermo-hygrometer	KIMO	HQ210	B4206022	06/15	06/16
Thermo-hygrometer (C2)	LACROSS Techn.	WS-2357	B4206015	08/14	08/15
Turntable controller (Cage#2)	ETS Lingren	Model 2066	F2000393	-	-
Turntable chamber (Cage#2)	ETS Lingren	Model 2165	F2000404	-	-
Table	LCIE	-	F2000438	-	-
Antenna Bi-log	CHASE	CBL6111A	C2040051	04/14	04/16
Cable	SUCOFLEX	106G	A5329061	03/15	03/16
Cable (OATS)	-	-	A5329623	10/14	10/15
OATS	-	-	F2000409	09/14	09/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	04/15	04/16
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372	-	-
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392	-	-
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403	-	-

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

4.6. TEST RESULTS

4.6.1. Pre-characterization at 3 meters [30MHz-1GHz]

See graphs:

Graph identifier	Polarization	EUT position	Comments	
Emr# 1	Vertical / Horizontal	Axis XY		See annex 1

4.6.2. Pre-characterization at 3 meters [1GHz-2GHz]

See graphs:

Graph identifier	Polarization	EUT position	Comments	
Emr# 2	Vertical / Horizontal	Axis XY		See annex 1

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

Worst case final data result:

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

No	Frequency (MHz)	Limit QPeak (dBµV/m)	Measure QPeak (dBµV/m)	Margin QPeak (dB)	Angle Table (°)	Pol. Ant.	Ht. Ant. (cm)	FC (dB)	Remark
1	35.947	40.0	36.5	**-3.5**	316	V	100	16.5	/
2	33.894	40.0	31.0	**-9.0**	300	V	100	17.6	/
3	47.921	40.0	39.0	**-1.0**	304	V	100	10.3	/
4	54.426	40.0	33.9	**-6.1**	180	V	100	8.6	/
5	58.984	40.0	28.9	**-11.1**	45	V	100	7.8	/
6	59.987	40.0	35.3	**-4.7**	0	V	100	7.6	/
7	120.046	43.5	32.0	**-11.5**	0	H	400	13.7	/
8	144.008	43.5	28.7	**-14.8**	180	H	400	13.5	/
9	193.528	43.5	37.5	**-6.0**	270	V	100	11.2	/
10	193.528	43.5	37.8	**-5.7**	215	H	350	11.2	/
11	483.823	46.0	44.2	**-1.8**	0	V	100	21.5	/
12	580.587	46.0	35.1	**-10.9**	180	V	100	23.4	/

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

4.6.4. Characterization on 3meters anechoic chamber from 1GHz to 2GHz

Worst case final data result:

The frequency list is created from the results obtained during the pre-characterization in anechoic chamber.
Measurements are performed using a PEAK and AVERAGE detection.

No	Frequency (MHz)	Limit Peak (dBµV/m)	Measure Peak (dBµV/m)	Margin Peak (dB)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin Average (dB)	Angle Table (°)	Pol. Ant.	Ht. Ant. (cm)	FC (dB)	Remark
No Significant Frequency observed												

Note: Measures have been done at 3m distance.

4.7. CONCLUSION

The sample of the equipment **IMP400-01B3145A**, Sn: **15124KT00004452**, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part15B, for radiated emissions.

5. UNCERTAINTIES CHART

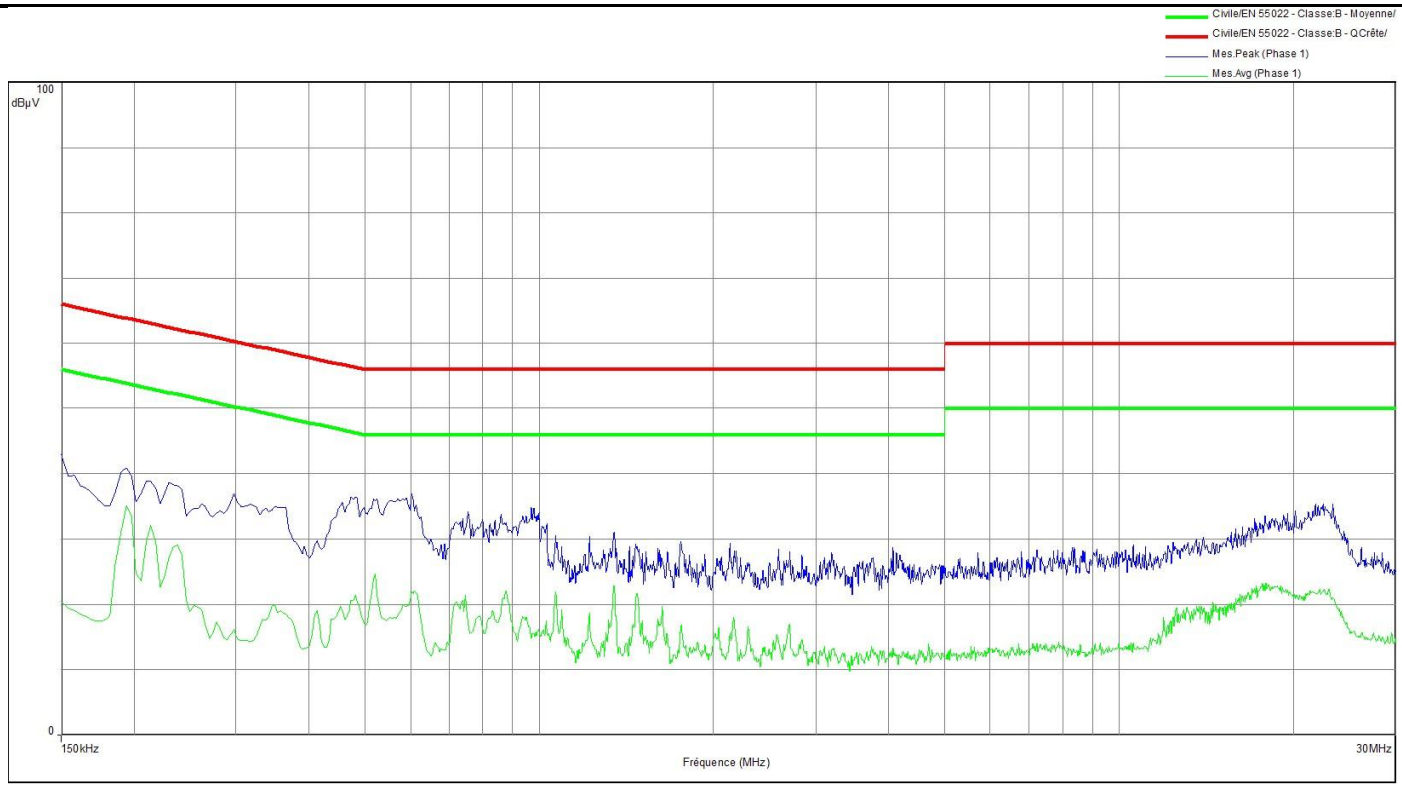
Type de mesure / *Kind of measurement*	**Incertitude élargie laboratoire / *Wide uncertainty laboratory* (k=2) ± x**	**Incertitude limite du CISPR / *CISPR uncertainty limit* ± y**
Mesure des perturbations conduites en tension sur le réseau d'énergie (triphasé) *Measurement of conducted disturbances 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

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. Ce tableau regroupe l'ensemble des incertitudes maximales pour les essais réalisables dans le laboratoire, qu'ils aient été ou non réalisés dans le cadre du présent rapport / *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. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report*

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)

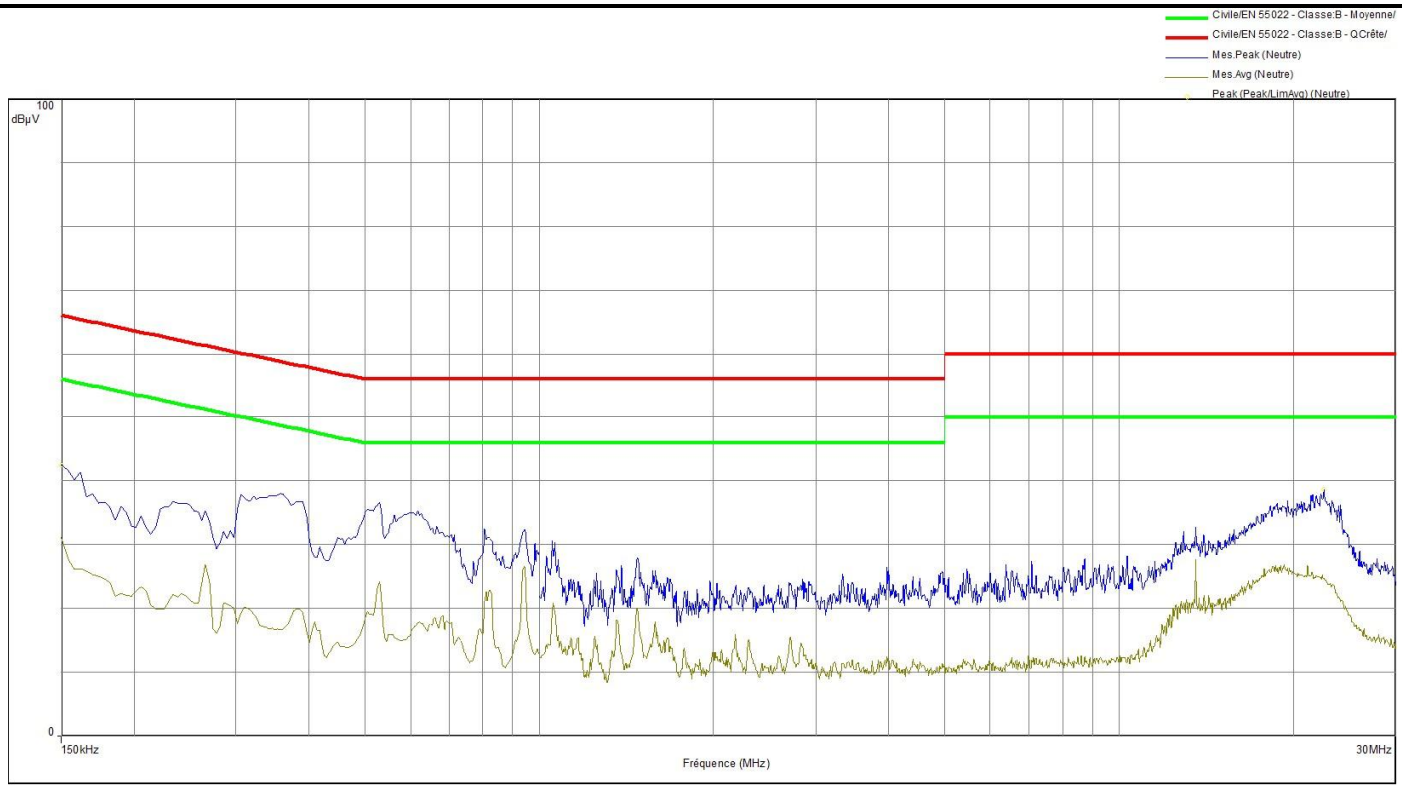
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	EN 55022	110V - L	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV)	LimM (dBµV)	Peak-LimM (dB)	Position
0.15	42.91	56	-13.09	Phase 1
1	33.11	46	-12.89	Phase 1
23.3	35.45	50	-14.55	Phase 1

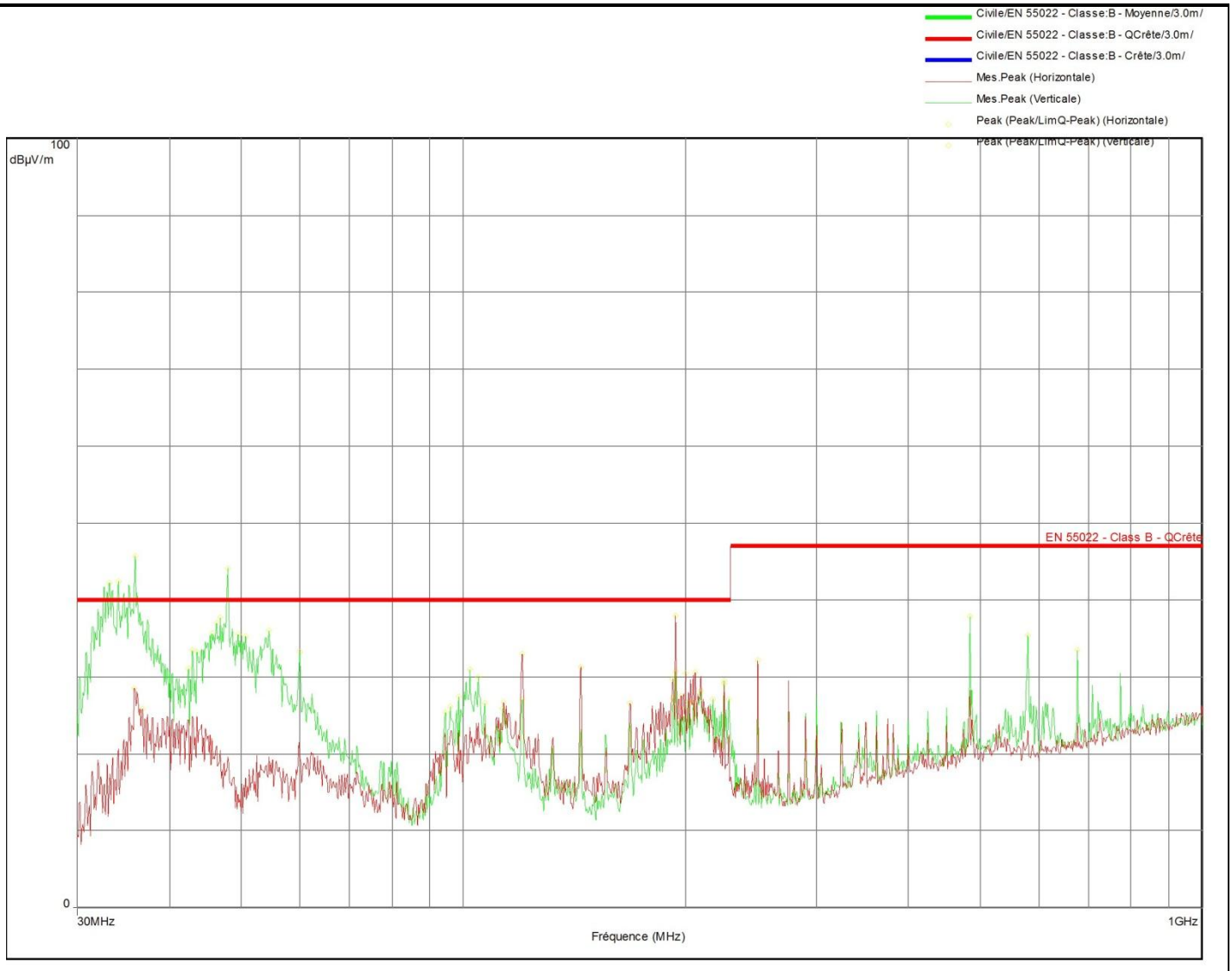
CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	EN 55022	110V - N	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV)	LimM (dBµV)	Peak-LimM (dB)	Position
0.15	42.52	56	-13.48	Neutre
22.568	38.72	50	-11.28	Neutre

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	EN 55022	(H+V) - Configuration 1 <1GHz essai 1	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Position
35.848	28.6	40	-11.4	Polarisation horizontale
36.766	25.94	40	-14.06	Polarisation horizontale
113.113	26.7	40	-13.3	Polarisation horizontale
120.1	33.03	40	-6.97	Polarisation horizontale
144.002	31.38	40	-8.62	Polarisation horizontale
167.938	26.59	40	-13.41	Polarisation horizontale
192.044	29.72	40	-10.28	Polarisation horizontale
193.54	38.03	40	-1.97	Polarisation horizontale
197.076	27.61	40	-12.39	Polarisation horizontale
200	30.54	40	-9.46	Polarisation horizontale
205.88	30.59	40	-9.41	Polarisation horizontale
225	29.18	40	-10.82	Polarisation horizontale
250	32.15	47	-14.85	Polarisation horizontale
33.145	42.24	40	2.24	Polarisation verticale
34.114	42.48	40	2.48	Polarisation verticale
35.933	45.66	40	5.66	Polarisation verticale
42.41	31.03	40	-8.97	Polarisation verticale
42.988	33.55	40	-6.45	Polarisation verticale
43.583	33.3	40	-6.7	Polarisation verticale
45.691	35.64	40	-4.36	Polarisation verticale
46.252	36.96	40	-3.04	Polarisation verticale
46.83	37.7	40	-2.3	Polarisation verticale
47.952	44.17	40	4.17	Polarisation verticale
49.55	35.54	40	-4.46	Polarisation verticale
50.723	35.36	40	-4.64	Polarisation verticale
54.565	36.02	40	-3.98	Polarisation verticale
59.971	33.21	40	-6.79	Polarisation verticale
94.413	25.38	40	-14.62	Polarisation verticale
95.841	26.19	40	-13.81	Polarisation verticale
98.493	27.4	40	-12.6	Polarisation verticale
101.91	30.97	40	-9.03	Polarisation verticale
104.783	30.03	40	-9.97	Polarisation verticale
106.704	26.59	40	-13.41	Polarisation verticale
113.045	25.83	40	-14.17	Polarisation verticale
120.015	27.05	40	-12.95	Polarisation verticale
192.044	27.19	40	-12.81	Polarisation verticale
193.523	30.73	40	-9.27	Polarisation verticale
200	25.99	40	-14.01	Polarisation verticale
201.28	26.9	40	-13.1	Polarisation verticale
204.32	26.55	40	-13.45	Polarisation verticale
209.48	28.19	40	-11.81	Polarisation verticale
217.28	27.11	40	-12.89	Polarisation verticale
225	29.5	40	-10.5	Polarisation verticale
228.52	27.05	40	-12.95	Polarisation verticale
483.88	37.8	47	-9.2	Polarisation verticale
580.52	35.44	47	-11.56	Polarisation verticale
677.32	33.49	47	-13.51	Polarisation verticale

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	EN 55022	(H+V) - Configuration 1 >1GHz essai 1	
Class:	B		
Frequency range: [1GHz - 2GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz

Spurious emissions