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TEST REPORT

N°: 840228-R1-E **JDE : 135368**

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	**ISMP2 Intelligent Docking Station**
Trade mark	**INGENICO**
Manufacturer	**INGENICO**
Model under test	**IMP400-01B3143A**
Serial number	**14347KT00004149**
Test date	From April 27th , 2015
Test location	Moirans
Test performed by	Majid MOURZAGH
Composition of document	19 pages
Last version	None
Document issued on	June 30th , 2015

Written 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 : 387 MHz (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.

Highest frequency: 387MHz (Declaration of provider)

2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
IMP400-01B3143A **Serial Number: 14347KT00004149**

Equipment Under Test

Power supply:
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	☑ AC ☐ DC ☐ Battery	100-240V 50/60Hz	Mean Well Model GS90A12-R7BBM1	Sn: EB4EC71609

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	AC/DC adaptor	2	☑	☐	☑	
LAN1	RJ45	1	☐	☑	☑	
LAN2	RJ45	1	☐	☑	☑	
USB	USB	-	☐	☐	☐	Not used during tests

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Laptop	TOSHIBA1	-	-
Laptop	TOSHIBA1	-	-
6 x ISMP2	INGENICO ISMP2	CEM iDS1; CEM IDS2; CEM iDS3 CEM iDS4; CEM iDS5; CEM iDS6	-

2.2. EUT CONFIGURATION – RUNNING MODE

Firmware / Software version of EUT: SDK 9.22 based
The EUT is connected to 2 laptop PC with its Ethernet link. (Ping function activated).
6 Auxiliaries are installed to be charged

2.3. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

2.4. SPECIAL ACCESSORIES

None

2.5. 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	:	April 27th , 2015
Test performed by	:	Majid MOURZAGH
Atmospheric pressure (hPa)	:	997
Relative humidity (%)	:	32
Ambient temperature (°C)	:	23

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 110Vac./ 60Hz

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

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
Cable	-	-	A5329578
LISN tri-phase ESH2-Z5	RHODE & SCHWARZ	33852.19.53	C2320062
Load 50Ω	-	-	A7152031
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

3.6. TEST RESULTS

Mains terminals:

Supply1
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 **IMP400-01B3143A**, Sn: **14347KT00004149**, 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)

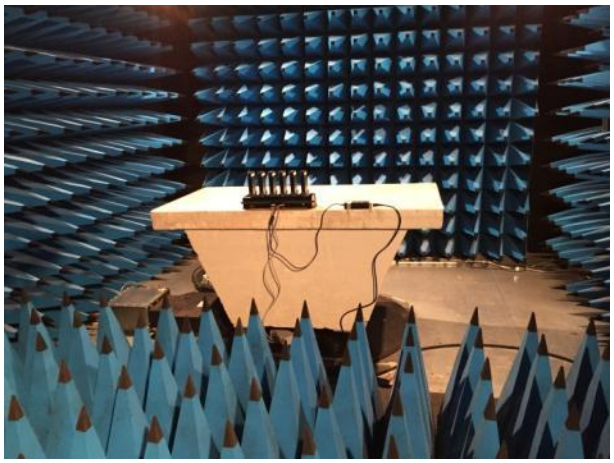
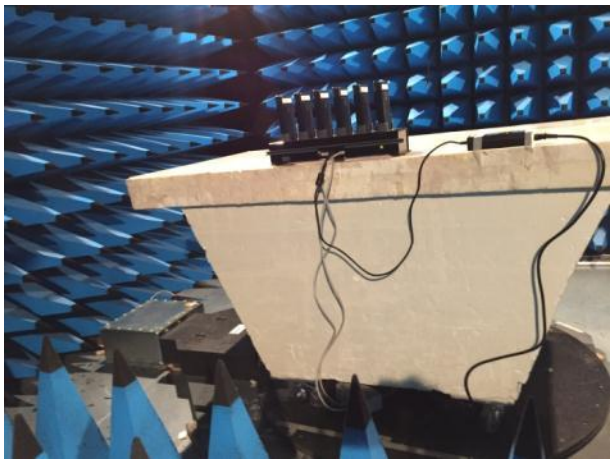
4.1. ENVIRONMENTAL CONDITIONS

Date of test	:	April 27th , 2015
Test performed by	:	Majid MOURZAGH
Atmospheric pressure (hPa)	:	997
Relative humidity (%)	:	32
Ambient temperature (°C)	:	23

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 230Vac.


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 XGHz.

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
Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447F	A7086006
Amplifier 1-6GHz	HEWLETT PACKARD	-	A7085016
Antenna Bi-log	CHASE	CBL6111A	C2040051
Antenna Bi-Log XWing	TESEQ	CBL6144	C2040146
Antenna horn	EMCO	3115	C2042027
Cable	SUCOFLEX	106G	A5329061
Cable (OATS)	-	-	A5329623
Emission Cable	MICRO-COAX	6GHz	A5329654
Emission Cable	MICRO-COAX	6GHz	A5329655
Emission Cable	MICRO-COAX	6GHz	A5329656
Semi-Anechoic chamber #2	SIEPEL	-	D3044015
Radiated emission comb generator	BARDET	-	A3169050
OATS	-	-	F2000409
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Receiver 20-1000MHz	ROHDE & SCHWARZ	ESVS30	A2642006
Thermo-hygrometer (C2)	LACROSS Techn.	WS-2357	B4206015
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392
Turntable controller (Cage#2)	ETS Lingren	Model 2066	F2000393
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403
Turntable chamber (Cage#2)	ETS Lingren	Model 2165	F2000404
Table	LCIE	-	F2000438

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	Comments	
Emr#	1	Vertical/ Horizontal		See annex 1

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

See graphs:

Graph identifier		Polarization	Comments	
Emr#	2	Vertical		See annex 1
Emr#	3	Horizontal		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	35.941	40.0	38.8	**-1.2**	0	V	100	16.5	See § 2.3
2	47.921	40.0	38.7	**-1.3**	0	V	100	10.3	See § 2.3
3	49.900	40.0	37.6	**-2.4**	180	V	110	9.4	See § 2.3
4	175.000	43.5	34.0	**-9.5**	270	V	110	11.9	See § 2.3
5	193.500	43.5	36.9	**-6.6**	0	V	110	11.3	See § 2.3
6	200.000	43.5	31.8	**-11.7**	200	H	100	11.1	See § 2.3
7	225.000	46.0	39.4	**-6.6**	270	V	110	13.3	See § 2.3
8	250.000	46.0	35.2	**-10.8**	45	H	280	15.6	See § 2.3
9	275.000	46.0	44.6	**-1.4**	110	V	180	16.0	See § 2.3

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.

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								

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
	No Significant Frequency observed								

Note: Measures have been done at 3m distance.

4.7. CONCLUSION

The sample of the equipment **IMP400-01B3143A**, Sn: **14347KT00004149**, 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

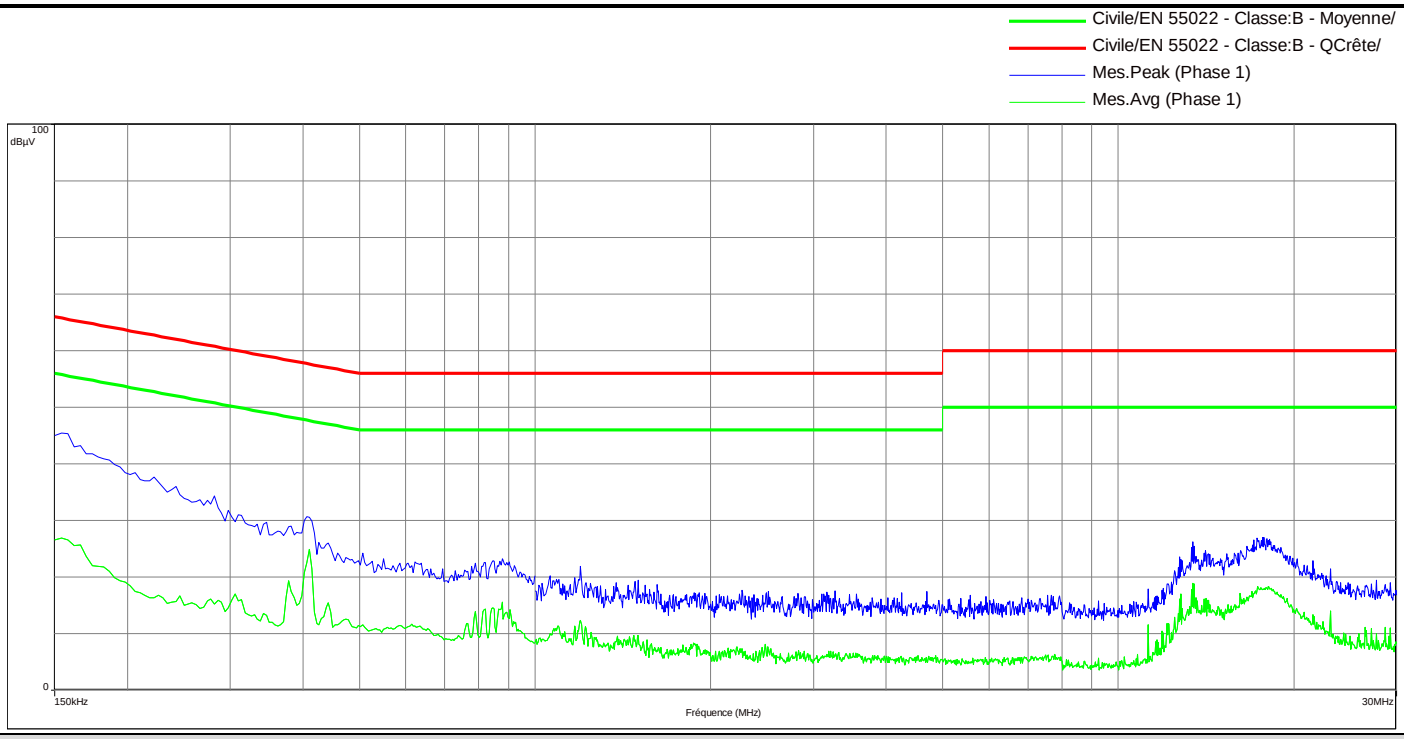
Type de mesure / *Kind of measurement*	**Incertitude élargie laboratoire / *Wide uncertainty laboratory* (k=2) ± x**	**Incertitude limite du CISPR / *CISPR uncertainty limit* ± y**
Mesure des perturbations conduites en tension sur le réseau d'énergie (triphasé) *Measurement of conducted disturbances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

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)

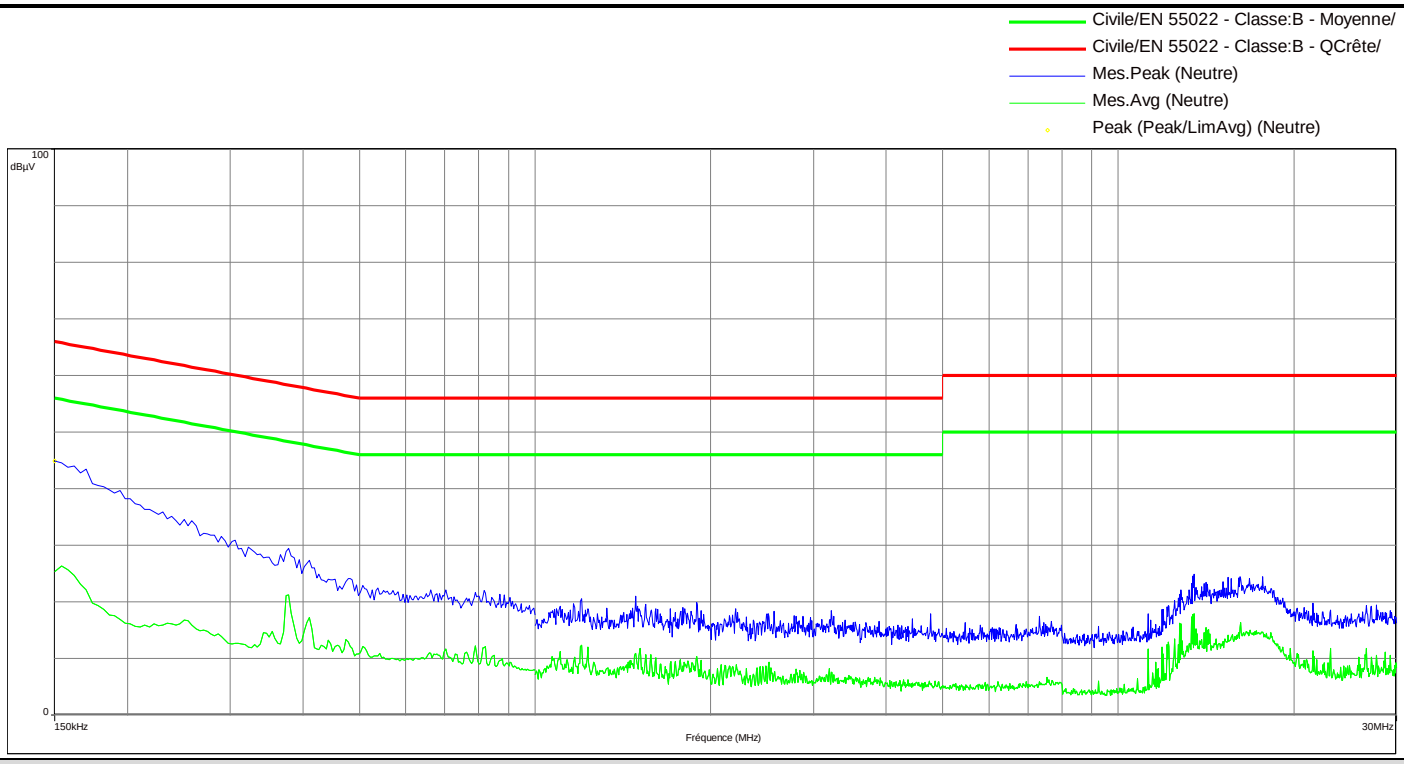
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	EN 55022	L1	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV)
0.154	45.39

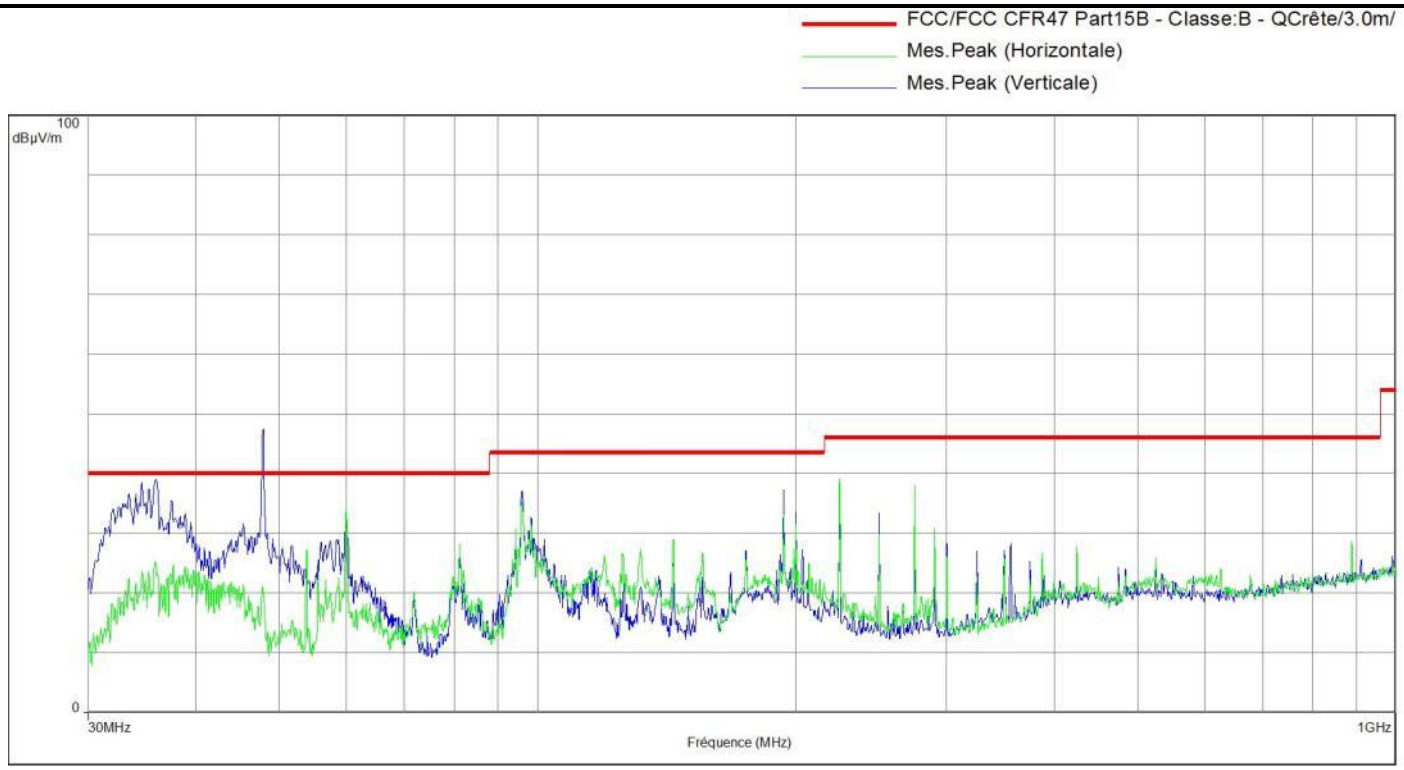
CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	EN 55022	Neutral	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV)
0.15	44.9

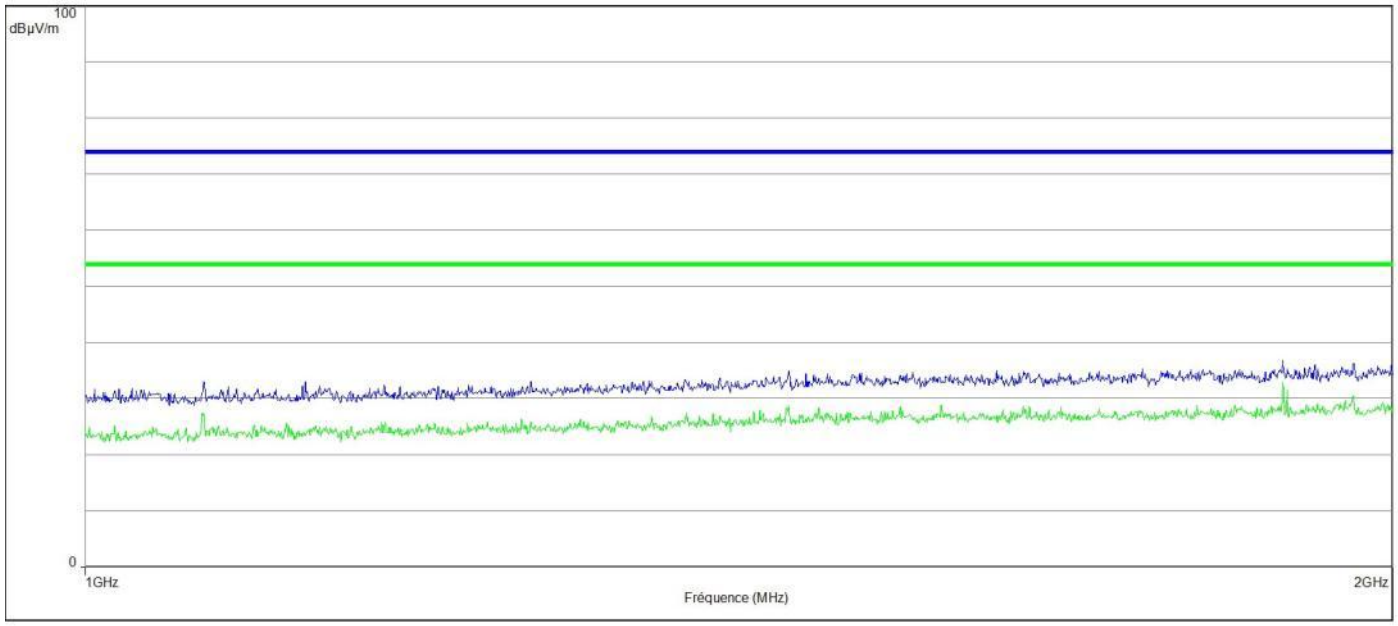
RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	(H+V) -	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

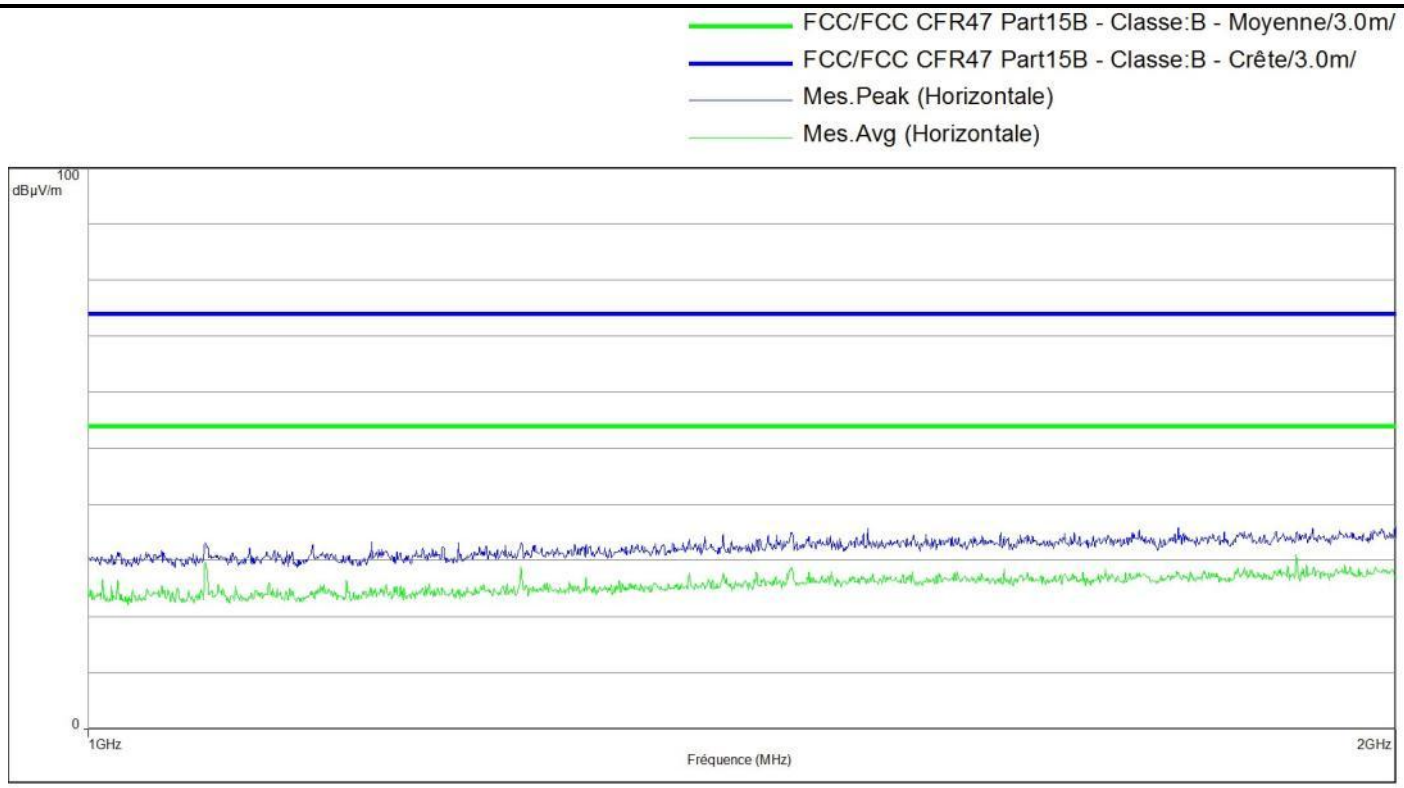
Frequency (MHz)	Peak (dBµV/m)	Position
35.933	25.27	Polarisation horizontale
125.812	26.59	Polarisation horizontale
193.574	32.92	Polarisation horizontale
200	31.58	Polarisation horizontale
225	39.16	Polarisation horizontale
275	38	Polarisation horizontale
35.95	39.08	Polarisation verticale
47.935	47.42	Polarisation verticale
175.044	27.08	Polarisation verticale
193.54	37.38	Polarisation verticale
200	33.67	Polarisation verticale
225	37.98	Polarisation verticale
250	33.38	Polarisation verticale
275	33.17	Polarisation verticale

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Pol (V) -	
Class:	B		
Frequency range: [1GHz - 2GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#3	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Pol (H) -	
Class:	B		
Frequency range: [1GHz - 2GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions