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TEST REPORT

N°: 838096-R1-E **JDE : 137851**

Subject	**Electromagnetic compatibility and Radio spectrum Matters (ERM) tests according to standards: FCC CFR 47 Part 15, Subpart B et C RSS-210 Issue 8.1**
Issued to	**INGENICO** Rovaltain TGV – Quartier de la Gare 9 Avenue de la gare 26958 VALENCE CEDEX 9
Apparatus under test	
Product	**Lecteur RFID / *RFID Reader***
Trade mark	**INGENICO**
Manufacturer	**INGENICO**
Model under test	**IUC160-01T3176A**
Serial number	**15232UN00000016**
FCCID	**XKB-IUC16XCL**
ICID	**2586D-IUC16XCL**
Test date	Du 18 au 28 Septembre 2015 / *From September 18th to 28th , 2015*
Test location	Moirans
IC Test site	6500A-1 & 6500A-3
Test performed by	Jonathan PAUC / Jonathan SARTO
Composition of document	31 pages
Modification of the last version	None
Document issued on	November 2nd, 2015

Written by :
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SUMMARY

1. TEST PROGRAM

Standard:

- FCC Part 15, Subpart C **- RSS-210 Issue 8.1 – Feb 2015**
- ANSI C63.10 (2013) **- RSS-Gen Issue 4 – Nov 2014**

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance at mains ports 150kHz-30MHz *CFR 47 §15.207*	**Frequency**	**Quasi-peak value (dBµV)**	**Average value (dBµV)**	☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz *CFR 47 §15.209 (a)* *CFR 47 §15.225* *RSS-Gen §4.9*	**Measure at 300m** 9kHz-490kHz : 67.6dBµV/m /F(kHz) **Measure at 30m** 490kHz-1.705MHz : 87.6dBµV/m /F(kHz) 1.705MHz-30MHz : 29.5 dBµV/m			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Radiated emissions 30MHz-2GHz* *CFR 47 §15.209 (a)* *CFR 47 §15.225* *RSS-Gen §4.9* ***Highest frequency : 390MHz (Declaration of provider)***	**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** ☐ **FAIL** ☐ **NA** ☐ **NP**
Fundamental field strength limit *CFR 47 §15.225* *RSS-210 §A2.6*	**Operation within the band 13.110-14.010 MHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Fundamental frequency tolerance *CFR 47 §15.225* *RSS-210 §A2.6*	**Operation within the band 13.110-14.010 MHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Band edge compliance *CFR 47 §15.225* *RSS-210 §A2.6*	**Operation within the band 13.110-14.010 MHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Occupied bandwidth *RSS-Gen §4.6.1*	**No limit**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Receiver Spurious Emission** *RSS-Gen §4.10*	**See RSS-Gen §4.10**			☐ **PASS** ☐ **FAIL** ☑ **NA** ☐ **NP**

***§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. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):

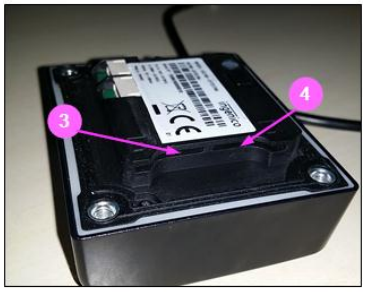
IUC160-01T3176A **Serial Number: 15232UN00000016**

Photography of EUT

Power supply:

During all the tests, EUT is supplied by V_{nom}: 5VDC
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	☐ AC ☑ DC ☐ Battery USB From Laptop	5V – 500mA	-	-



Inputs/outputs - Cable					
Access	**Type**	**Length used (m)**	**Declared <3m**	**Shielded**	**Under test**
Access1	USB power supply	2	☑	☑	☑
Access2	COM0 RS232	2	☑	☐	☑
Access3	SAM2	/	☐	☐	☑
Access4	SAM1	/	☐	☐	☑
Access5	µSD Card – MMC	/	☐	☐	☑
Access6	Wake Up (2 Wires)	0.3	☑	☐	☑

Auxiliary equipment used during test			
Type	**Reference**	**Sn**	**Comments**
Laptop LENOVO	8896-2FG	L3-B7463	

Equipment information:

RF module:	NC			
Frequency band:	[13.553–13.567] MHz			
Sub-band REC7003:	Annexe g(f)			
RF mode:	☐Transmitter	☑Transceiver	☐Receiver	☐Standby
Product class § 7.1.4	☑1	☐2	☐3	
Receiver classification § 4.1.1	☐1	☑2	☐3	
Antenna type:	☐External:		☑Internal:	
Antenna gain:	NC			
Extreme temperature range:	☑Category I (General) -20°C to +55°C Performed at-30°C to +70°C	☐Category II (Portable) -10°C to +55°C	☐Category III (Indoor) +5°C to +35°C	
Extreme test source voltage:	☐±10%:		☑other: 5V – 5.5Vdc	

NC : Not communicated by customer

2.2. EUT RUNNING MODE

Firmware / Software version of EUT: Appli : App_Cem.

A continuous reading process is performed between EUT and Contact less Card through RFID Protocol.
A continuous Writing/reading process is performed between SAM card & EUT / also between MMC & EUT.

2.3. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

2.4. 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 52.5dBµV 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 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.

2.5. CALIBRATION DATE

The calibration intervals are extended at 12+2 months. This extended interval is based on the fact that there is sufficient calibration data to statistically establish a trend or based on experience of use of the test equipment to assure good measurement results for a longer period

3. CONDUCTED EMISSION DATA

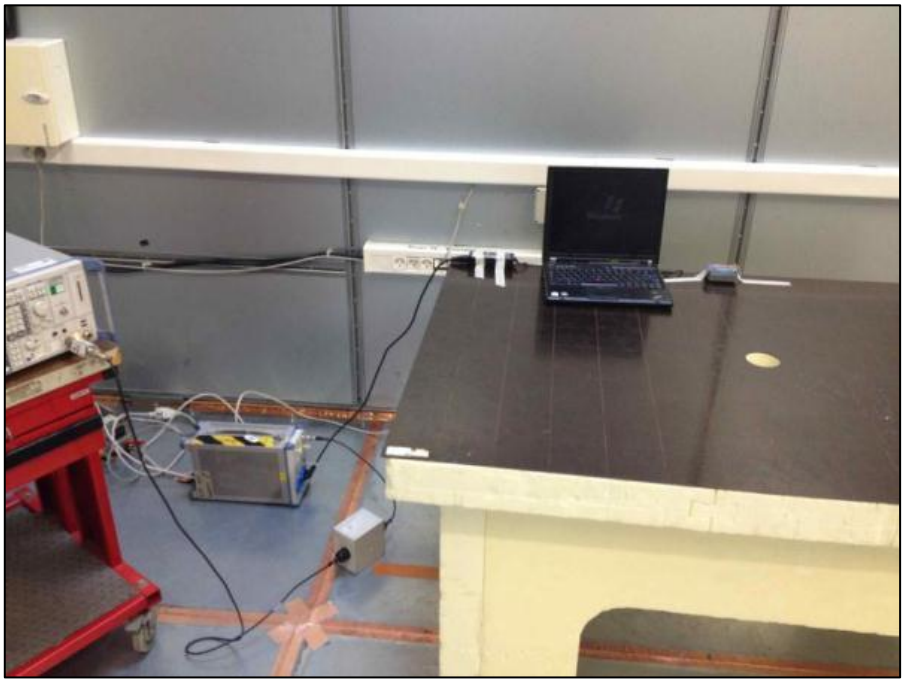
3.1. ENVIRONMENTAL CONDITIONS

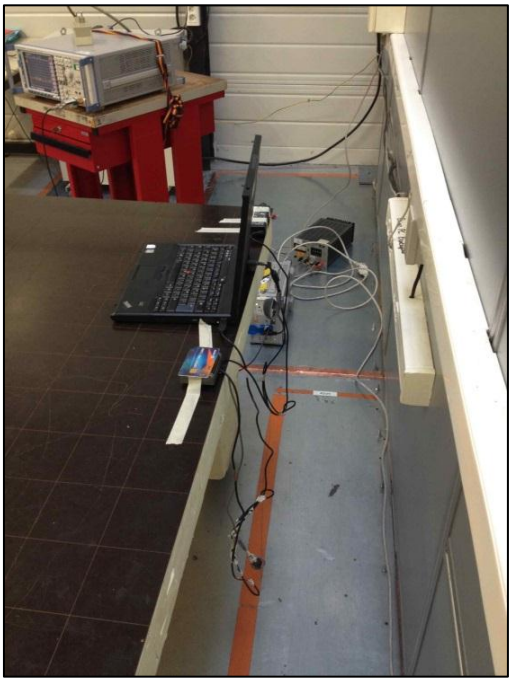
Date of test	September 30th, 2015
Test performed by	Jonathan SARTO
Atmospheric pressure (hPa)	1001
Relative humidity (%)	36
Ambient temperature (°C)	21

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

3.3. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + self	-	-	A5329578	07/15	07/16
Conducted emission comb generator	BARDET	-	A3169049	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320123	02/15	02/16
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	04/15	04/16
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	09/15	09/16
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204	11/14	11/15

3.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

3.5. 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
Emc#	3	Phase	Dummy load	See annex 1
Emc#	4	Neutral	Dummy load	See annex 1

3.6. CONCLUSION

The sample of the equipment IUC160-01T3176A Sn: 15232UN00000016, tested in the configuration presented in this test report satisfies to requirements of class B limits of the standard FCC Part15C, for conducted emissions.

4. RADIATED EMISSION DATA (15.209)

4.1. ENVIRONMENTAL CONDITIONS

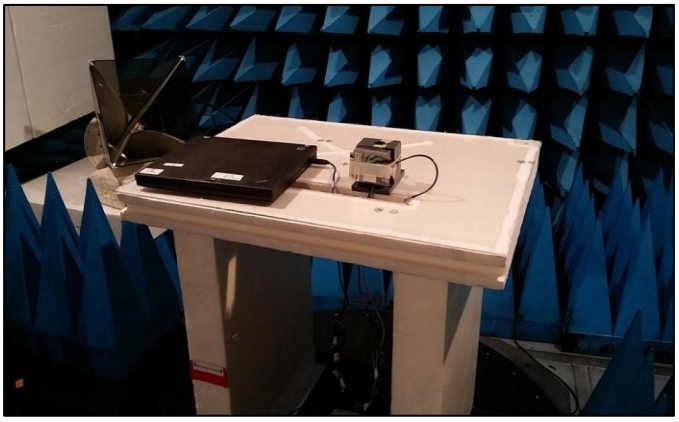
Date of test	:	September 18th , 2015	September 21st, 2015
Test performed by	:	J.PAUC	J.PAUC
Atmospheric pressure (hPa)	:	990	991
Relative humidity (%)	:	46	44
Ambient temperature (°C)	:	22	21

4.2. TEST SETUP

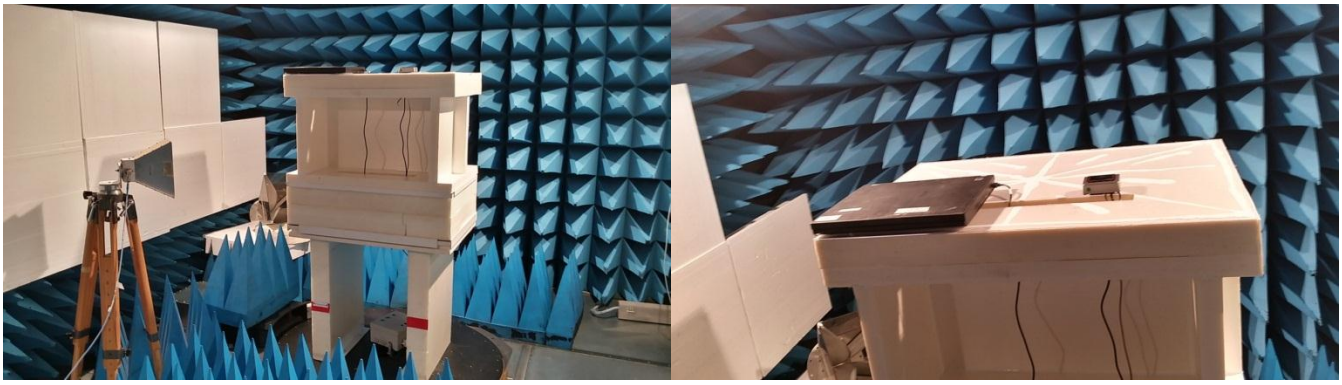
The installation of EUT is identical for pre-characterization measures in a 3 meters semi- anechoic chamber and for measures on the 10 meters Open site.
The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment) - Below 1GHz
☑ 150cm above the ground on the non-conducting table (Table-top equipment) - Above 1GHz
☐ 10cm above the ground on isolating support (Floor standing equipment)
The EUT is powered by V_{nom}.

Test setup on OATS – Worst case

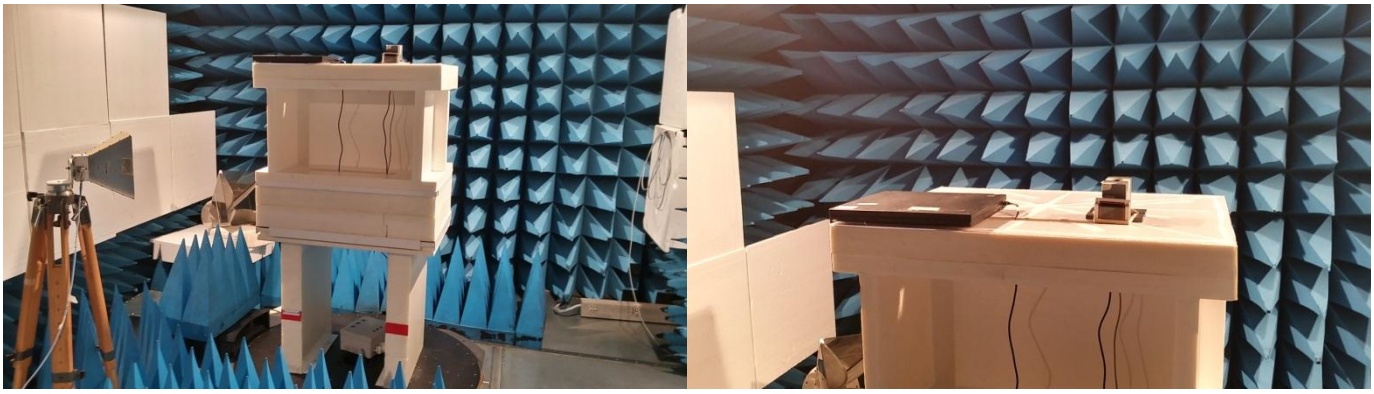

Test setup in anechoic chamber (Pos XY) – setup <1GHz

Test setup in anechoic chamber (Pos Z) – setup <1GHz



Test setup in anechoic chamber (Pos XY) – setup >1GHz



Test setup in anechoic chamber (Pos Z) – setup >1GHz

4.3. TEST METHOD

Pre-characterisation measurement: (9kHz – 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, the loop antenna was rotated 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 9kHz to 1GHz:

The product has been tested according to ANSI C63.10, 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 below 30MHz and 120kHz from 30 MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated 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 and C §15.209 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 (EUT smaller than the beamwidth of the measurement antenna, ANSI C63.10 §6.6.5)

Frequency list has been created with anechoic chamber pre-scan results.

4.4. TEST EQUIPMENT LIST

Anechoic chamber					
DESCRIPTION	**MANUFACTURER**	**MODEL**	**N° LCIE**	**Cal_Date**	**Cal_Due**
Antenna Bi-log	CHASE	CBL6111A	C2040172	06/15	06/17
Cable Measure @3m	-	-	A5329038	08/14	10/15
Cable Measure @3m	-	-	A5329206	04/15	04/16
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	-	-
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	01/15	01/16
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	04/15	04/16
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
Table	LCIE	-	F2000461	-	-
Horn Antenna	EMCO	3115	C2042029	09/14	09/15
Amplifier 1-6GHz	HEWLETT PACKARD	-	A7085016	10/14	10/15

OATS					
DESCRIPTION	**MANUFACTURER**	**MODEL**	**N° LCIE**	**Cal_Date**	**Cal_Due**
Antenna Bi-log	CHASE	CBL6111A	C2040051	04/14	04/16
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	10/13	10/15
Cable	SUCOFLEX	106G	A5329061	03/15	03/16
Cable (OATS)	-	-	A5329623	10/14	10/15
Radiated emission comb generator	BARDET	-	A3169050	-	-
OATS	-	-	F2000409	09/14	09/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	04/15	04/16
Receiver 20-1000MHz	ROHDE & SCHWARZ	ESVS30	A2642006	05/15	05/16
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	07/15	07/16
Antenna mast (OATS)	LCIE	-	F2000288	-	-
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	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 [9kHz-30MHz]

See graph for 9kHz-30MHz band:

Graph identifier		Polarization	EUT position	Comments	
Emr#	1	0°	Axis XY		See annex 1
Emr#	2	90°	Axis XY		See annex 1

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

See graphs for 30MHz-1GHz:

Graph identifier		Polarization	EUT position	Comments	
Emr#	3	Vertical & Horizontal	Axis XY		See annex 1
Emr#	4	Vertical & Horizontal	Axis Z		See annex 1

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

See graphs for 1GHz-2GHz:

Graph identifier	Polarization	EUT position	Comments	
Emr# 5	Vertical & Horizontal	Axis XY		See annex 1
Emr# 6	Vertical & Horizontal	Axis Z		See annex 1

4.6.4. Characterization on 10 meters open site below 30 MHz

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)	QPeak Limit (dBµV/m) @ 30m	Qpeak (dBµV/m) @ 30m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
1	13.56	84	40.4	**-43.6**	96	90	100	35.1	-
2	27.119	29.5	14	**-15.5**	90	90	100	45.0	-

Note: 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

See following chapter of this test report for band edge measurements.

4.6.5. 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	39.826	40.0	36.9	**-3.1**	154	V	100	14.4	/
2	40.678	40.0	33.4	**-6.6**	162	V	100	13.9	/
3	41.526	40.0	38.0	**-2.0**	143	V	100	13.5	/
4	42.852	40.0	33.3	**-6.7**	139	V	322	12.8	/
5	47.999	40.0	32.8	**-7.2**	9	V	100	10.3	/
6	59.995	40.0	32.1	**-7.9**	221	V	230	7.6	/
7	67.786	40.0	35.3	**-4.7**	274	V	250	7.8	/
8	96.328	43.5	29.8	**-13.7**	194	V	200	11.3	/
9	116.224	43.5	27.8	**-15.7**	153	V	150	13.4	/
10	209.64	43.5	32.3	**-11.2**	31	H	400	11.8	/
11	290.28	46.0	41.6	**-4.4**	320	H	343	16.2	/
12	483.82	46.0	43.3	**-2.7**	140	H	230	21.5	/
13	628.96	46.0	34.9	**-11.1**	31	H	183	24.4	/
14	870.876	46.0	38.8	**-7.2**	360	V	211	28.3	/

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

4.6.6. 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
1	1957.150	74.0	55.7	**-18.3**	54.0	48.8	**-5.2**	94	V	100	29.4	/
2	1660.800	74.0	48.6	**-25.4**	54.0	38.3	**-15.7**	87	V	100	28.3	/
3	1451.540	74.0	44.4	**-29.6**	54.0	33.4	**-20.6**	98	V	100	27.4	/

Note: Measures have been done at 3m distance.

4.7. CONCLUSION

The sample of the equipment IUC160-01T3176A Sn: 15232UN00000016, tested in the configuration presented in this test report satisfies to requirements of class B limits of the standard FCC Part15B and C, for radiated emissions.

5. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)

5.1. ENVIRONMENTAL CONDITIONS

Date of test	:	September 28th, 2015
Test performed by	:	J.PAUC
Atmospheric pressure (hPa)	:	999
Relative humidity (%)	:	41
Ambient temperature (°C)	:	22

5.2. TEST SETUP

Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz
The equipment (IUC 160) is set in a climatic chamber. Measure is performed on one channel of RF module.

Test setup

5.3. TEST METHOD

The frequency tolerance of the carrier signal shall be maintained within ±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 5 to 5.5Vdc of the rated supply voltage at 20°C.

5.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	LCIE	-	-	-	-
Cable Measure	-	40G	A5329653	12/14	12/15
Multimeter - CEM	FLUKE	87	A1240251	06/15	06/16
Power supply DC 300W / 150V-6A	SODILEC	7SDLIN/GB AUTO 300	A7043036	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	07/15	07/16
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	07/14	09/15
Cable	MICRO-COAX	-	A5329653	04/15	04/16
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	12/13	12/15

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☐ None ☑ Divergence: According to USB recommendation : Voltage range is set from 5V to 5.5Vdc

EUT doesn't work at a voltage below 5Vdc

5.6. TEST RESULTS

Temperature / Voltage	-30°C	-20°C	20°C	+70°C
Mains voltage: 5Vdc (V_{nom})				
Frequency Drift (MHz)	+ 0.000083	+ 0.000051	**REF**	- 0.000073
Carrier level (dBc)	+ 2.00	+ 1.5	**REF**	+ 2.60
Mains voltage: 5.5Vdc (V_{max})				
Frequency Drift (MHz)	+ 0.000083	+ 0.000051	+ 0.000000	- 0.000073
Carrier level (dBc)	+ 3.00	+ 1.50	+ 0.00	+ 2.60

Frequency drift measured is **83Hz** when the temperature is varied from -30°C to +70°C and voltage is varied.

5.1. CONCLUSION

The sample of the equipment IUC160-01T3176A Sn: 15232UN00000016, tested in the configuration presented in this test report satisfies to requirements of the standard FCC Part15C, for fundamental frequency tolerance.

6. BAND-EDGE COMPLIANCE §15.209

6.1. ENVIRONMENTAL CONDITIONS

Date of test	:	September 28th, 2015
Test performed by	:	J.PAUC
Atmospheric pressure (hPa)	:	999
Relative humidity (%)	:	41
Ambient temperature (°C)	:	22

6.2. TEST SETUP

For measurement, the power level calibration of the spectrum analyzer is related to the field strength measured in chapter radiated emission data.

Test setup

6.3. TEST METHOD

Frequency band 13.110-14.010MHz
Following plots show radiated emission level in the frequency band 13.110-14.010MHz with a RBW of 9kHz and a quasi-peak detector. The graphs are obtained with a measuring receiver.

Frequency band 13.553-13.567MHz
Following plots show radiated emission level in the frequency band 13.55.-13.567MHz with a RBW of 1kHz. The graphs are obtained with a measuring receiver.

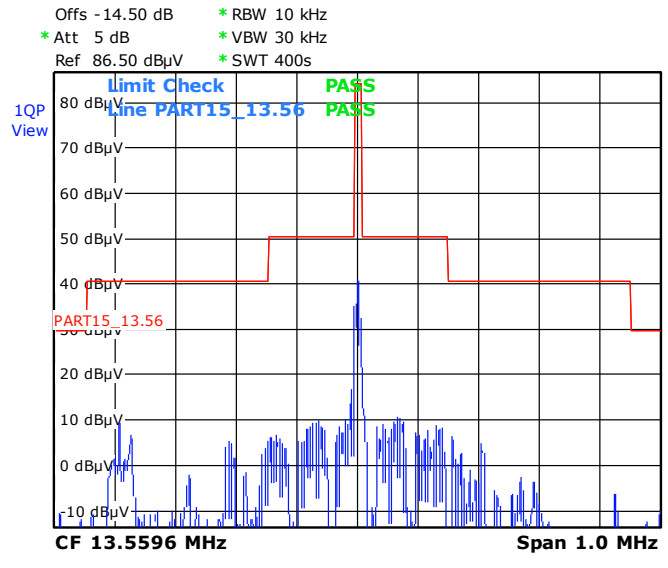
6.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	LCIE	-	-	-	-
Cable Measure	-	40G	A5329653	12/14	12/15
Multimeter - CEM	FLUKE	87	A1240251	06/15	06/16
Power supply DC 300W / 150V-6A	SODILEC	7SDLIN/GB AUTO 300	A7043036	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	07/15	07/16
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	07/14	09/15
Cable	-	MICRO-COAX	A5329653	04/15	04/16
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	12/13	12/15

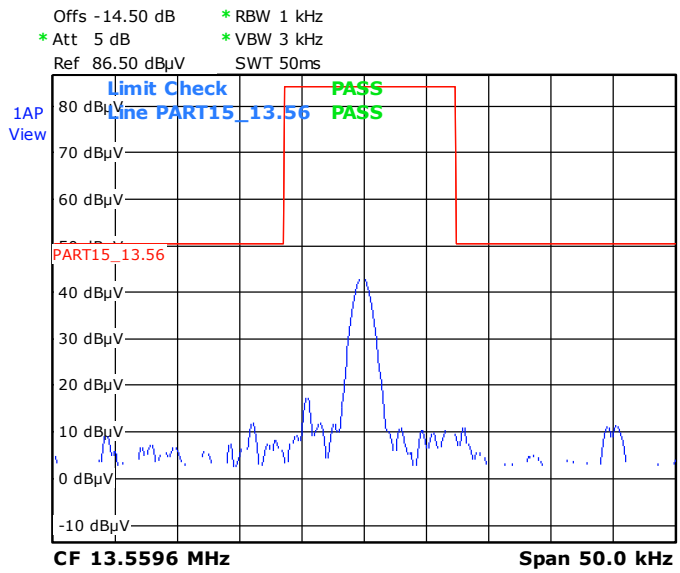
6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

6.6. TEST RESULTS



Frequency band 13.110-14.010MHz



Frequency band 13.553-13.567MHz

6.7. CONCLUSION

The sample of the equipment IUC160-01T3176A, Sn: 15232UN00000016, tested in the configuration presented in this test report satisfies to requirements of the standard FCC Part15C, for band-edge compliance.

7. OCCUPIED BANDWIDTH

7.1. ENVIRONMENTAL CONDITIONS

Date of test : September 28th, 2015
Test performed by : J.PAUC
Atmospheric pressure (hPa) : 999
Relative humidity (%) : 41
Ambient temperature (°C) : 22

7.1. SETUP

☐ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
Offset: Attenuator+cable 10.3dB

☑ ***Radiated measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

Measurement Procedure:
1. RBW used should not be lower than 1% of the selected span
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. OBW 99% function of spectrum analyzer used

7.2. TEST EQUIPMENT LIST

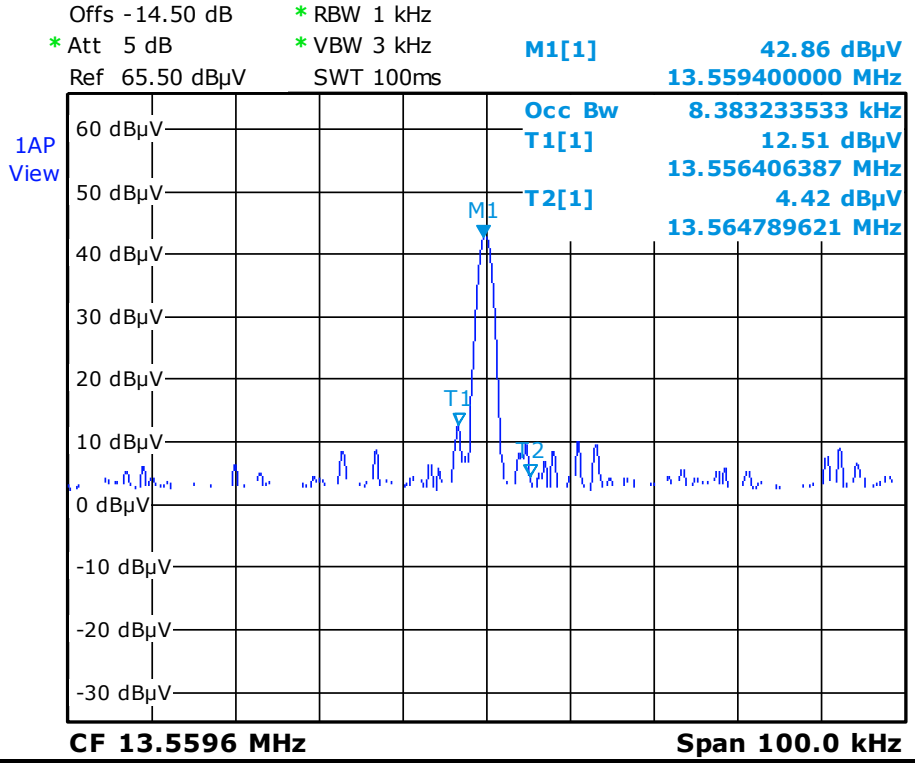
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	LCIE	-	-	-	-
Cable Measure	-	40G	A5329653	12/14	12/15
Multimeter - CEM	FLUKE	87	A1240251	06/15	06/16
Power supply DC 300W / 150V-6A	SODILEC	7SDLIN/GB AUTO 300	A7043036	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	07/15	07/16
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	07/14	09/15
Cable	-	MICRO-COAX	A5329653	04/15	04/16

7.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

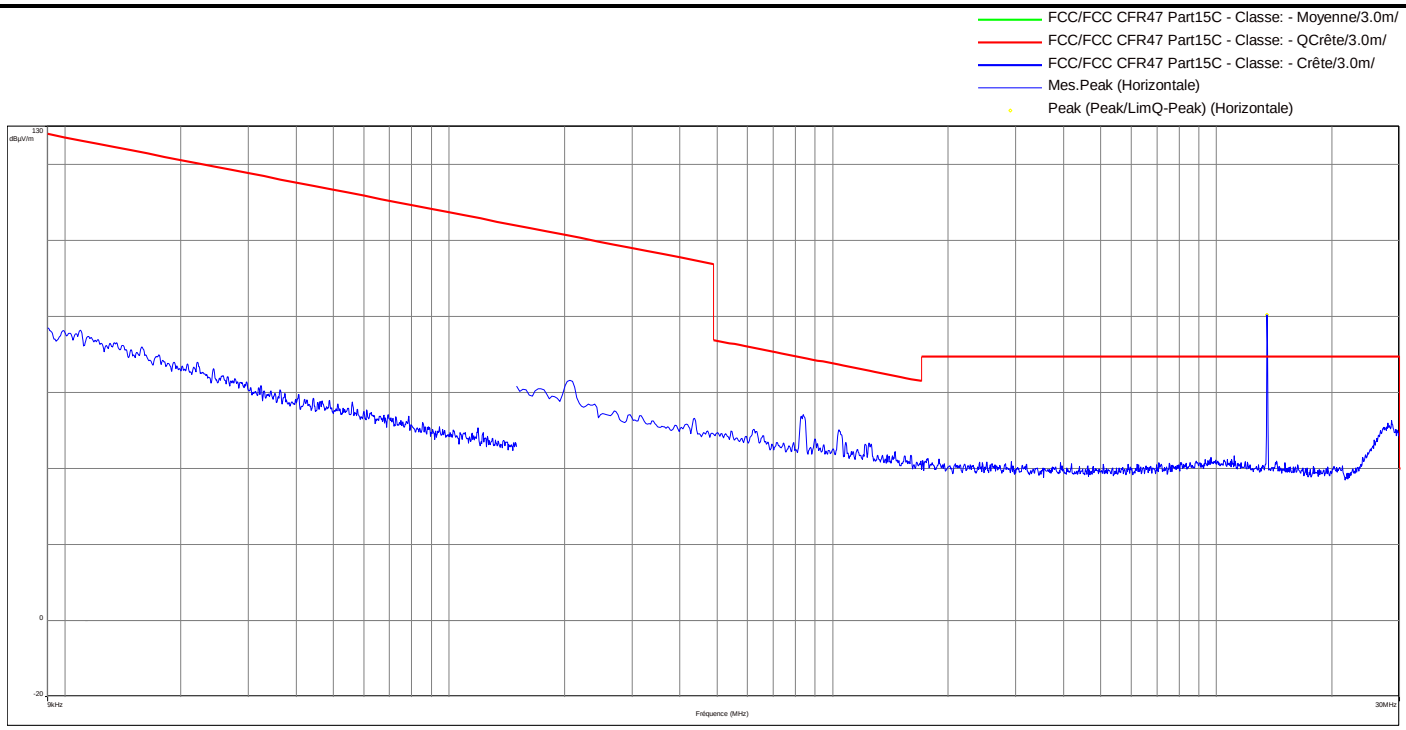
7.4. TEST SEQUENCE AND RESULTS

Frequency (MHz)	99% Occupied Bandwidth (kHz)
13.56	**8.4**



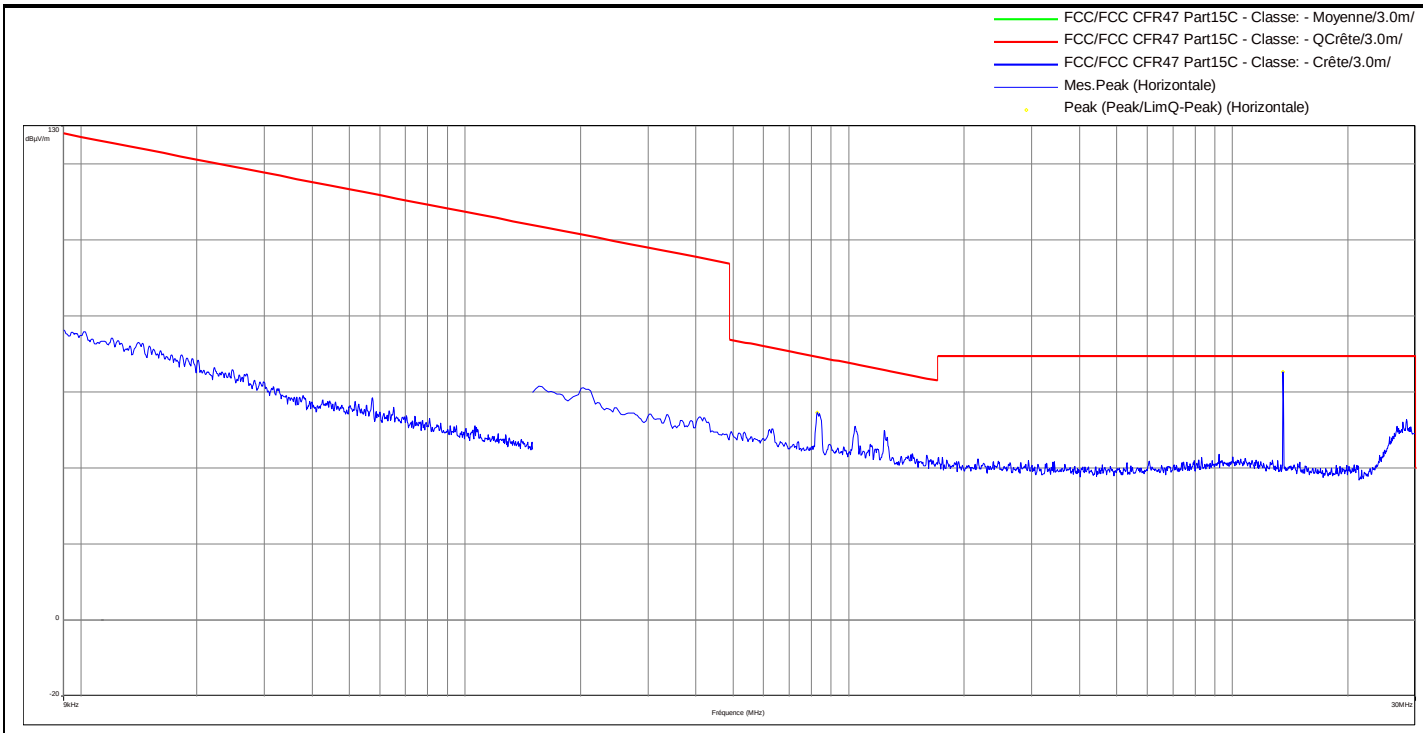
8. ANNEX 1 (GRAPHS)

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	Pre-characterisation - (0°) - (Worst case)	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



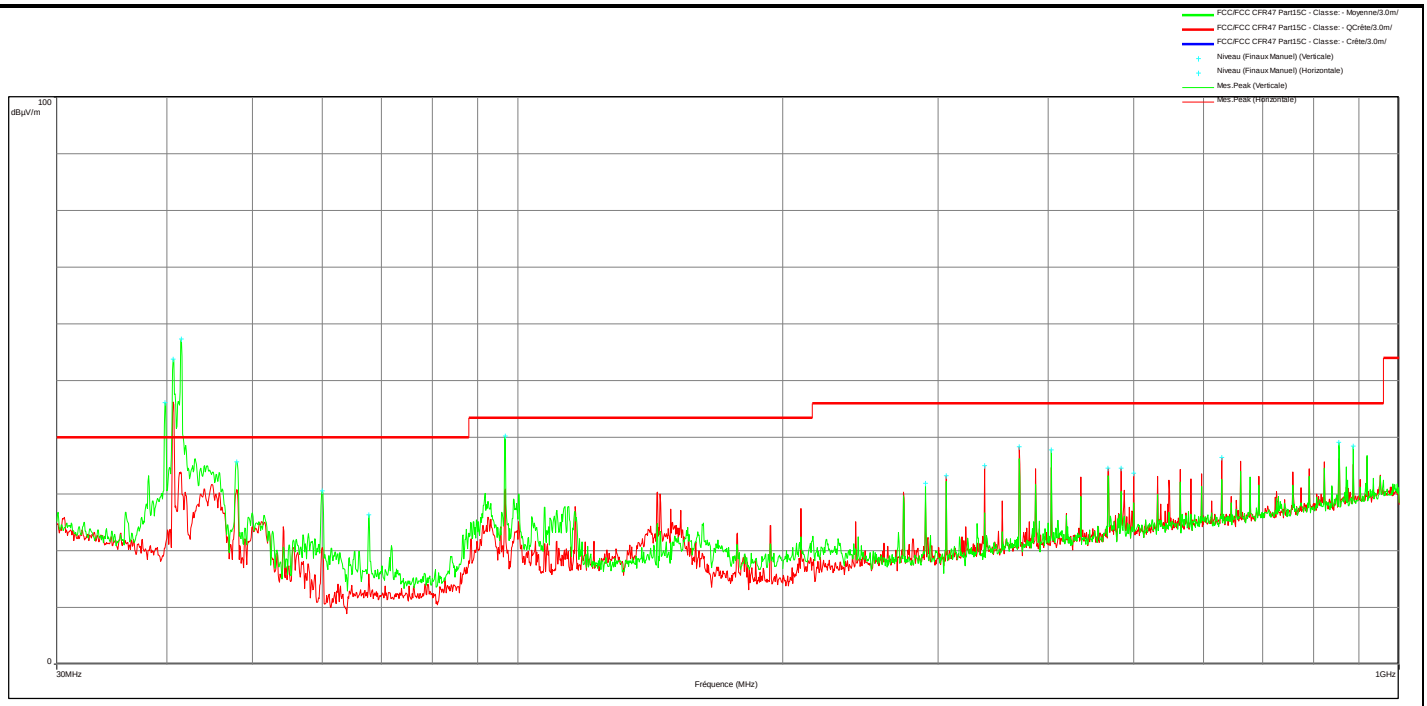
Frequency (MHz)	Peak Level (dBµV/m)
13.55862	80.46

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	Pre-characterisation - (90°) - (Worst case)	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



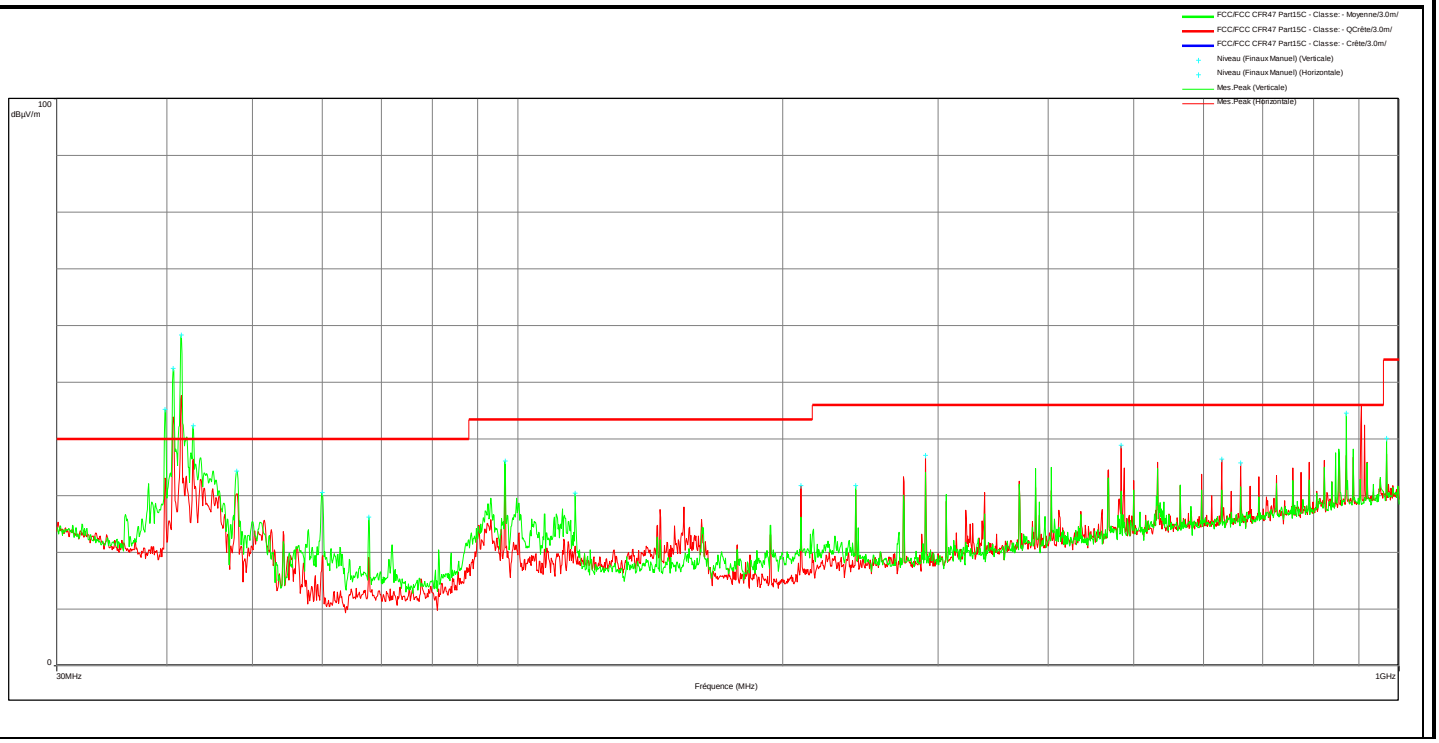
Frequency (MHz)	Peak Level (dBµV/m)
0.827595	54.61
13.55862	65.27

RADIATED EMISSIONS			
Graph name:	Emr#3	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Pos XY	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



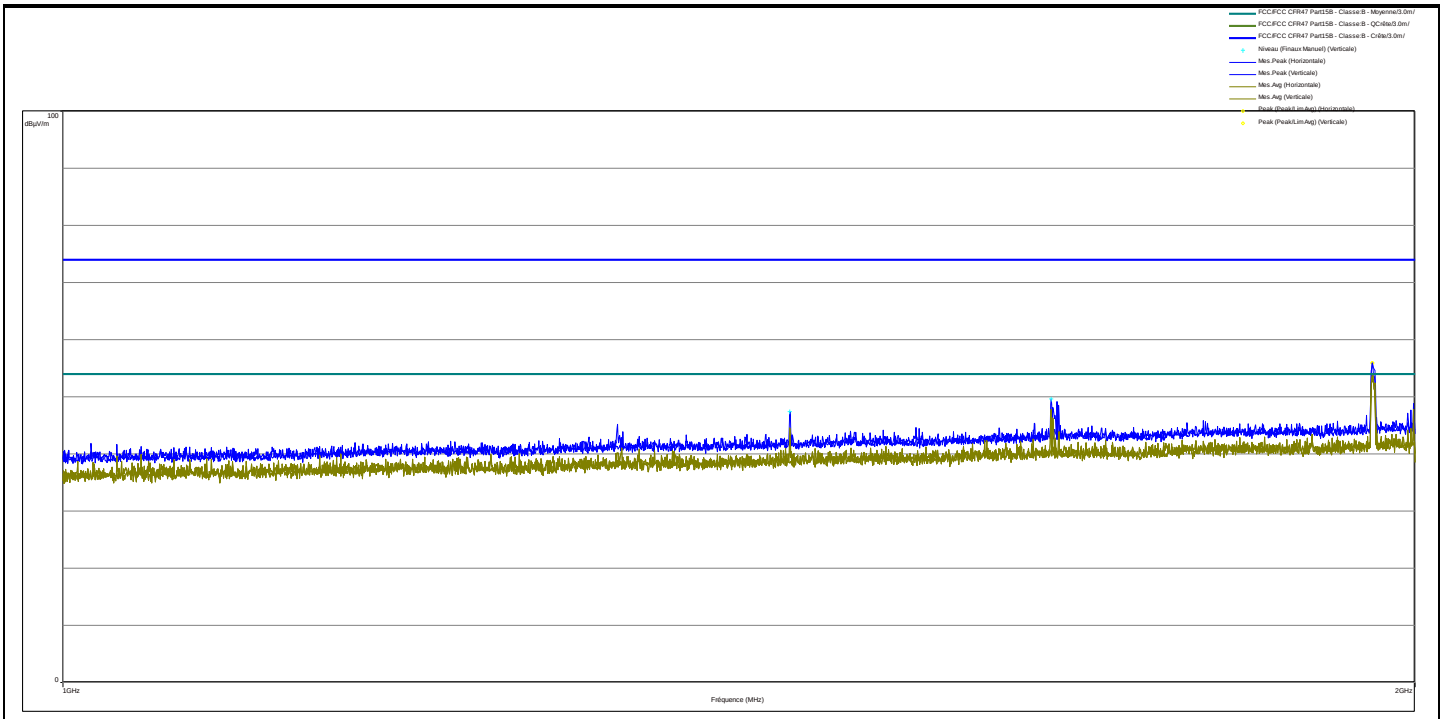
Frequency (MHz)	Peak Level (dBµV/m)
39.826	46.1
40.676	53.77
41.509	57.32
47.969	35.65
60.022	30.58
67.791	26.35
96.759	40.22
290.28	31.88
403.16	37.79
854.76	39.06
887	38.42
306.4	33.19
338.68	35.05
370.92	38.28
467.68	34.58
483.84	34.55
499.96	33.71
628.96	36.43

RADIATED EMISSIONS			
Graph name:	Emr#4	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Pos Z	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Frequency (MHz)	Peak Level (dBµV/m)
39.826	45.26
40.676	52.44
41.526	58.31
42.852	42.33
48.02	34.33
59.988	30.53
67.791	26.23
96.759	36.11
116.224	30.41
241.88	31.8
870.88	44.59
967.64	40.11
209.64	31.73
290.28	37.07
483.84	38.9
628.96	36.49
661.2	35.79

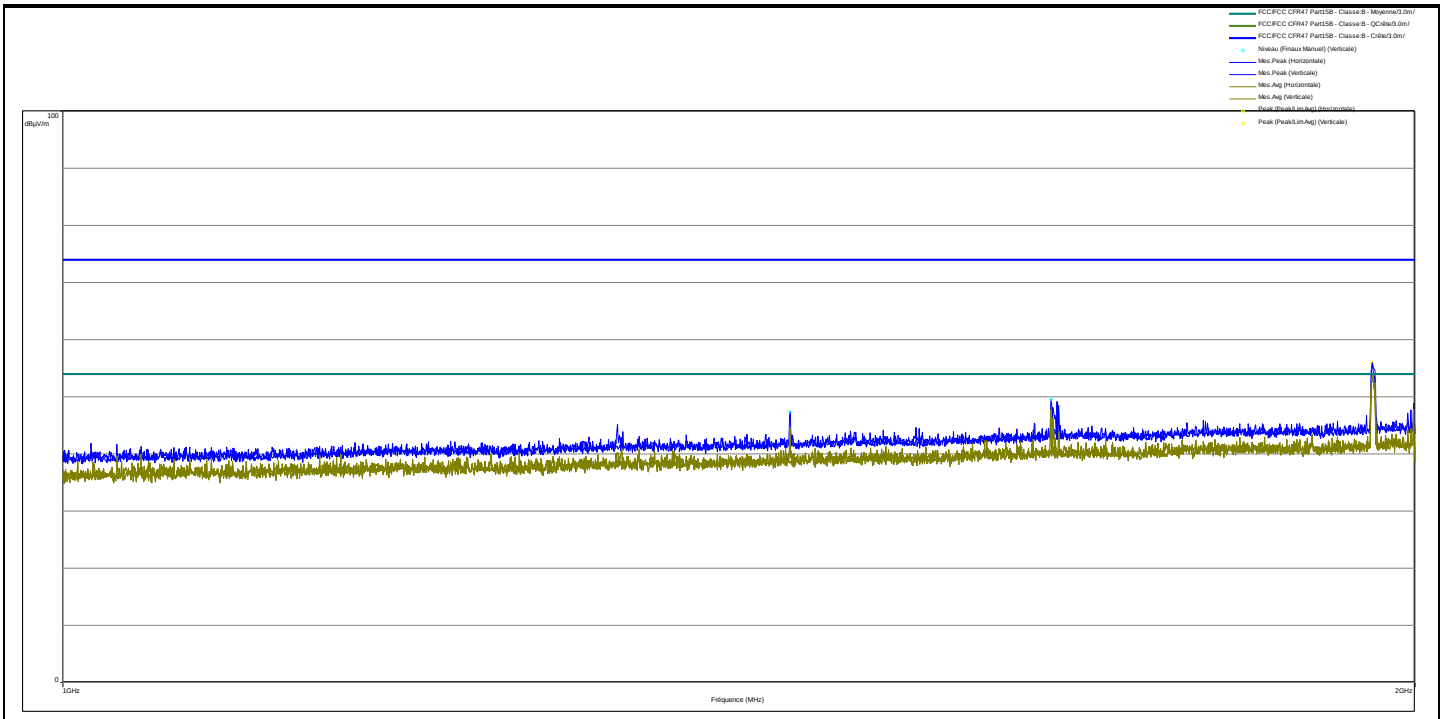
RADIATED EMISSIONS			
Graph name:	Emr#5	**Test configuration:**	
Limit:	FCC CFR47 Part15B	(H+V) – Pos XY	
Class:	B		
Frequency range: [1GHz - 2GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Position
1956.6	55.89	Polarisation horizontale
1956.8	55.97	Polarisation verticale
1451.6	47.45	Polarisation verticale
1659.7	49.65	Polarisation verticale

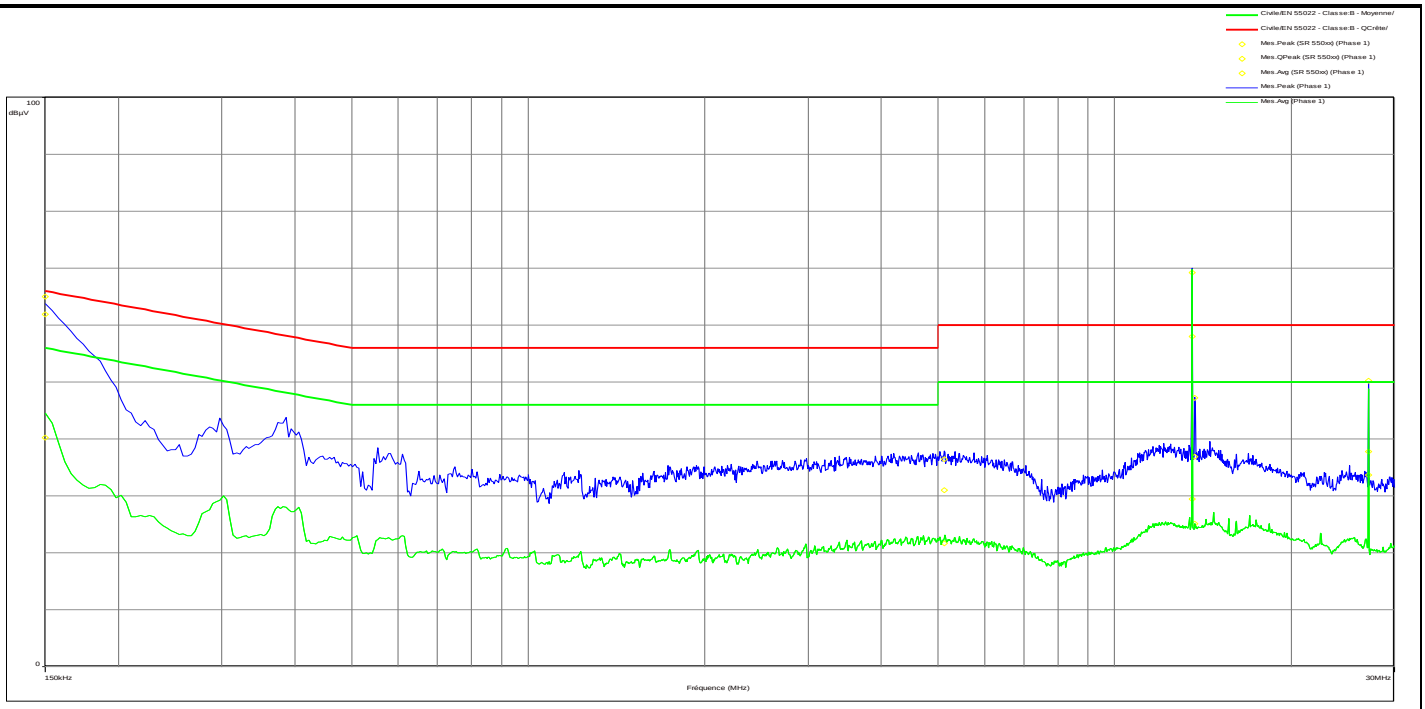
RADIATED EMISSIONS			
Graph name:	Emr#6	**Test configuration:**	
Limit:	FCC CFR47 Part15B	(H+V) – Pos Z	
Class:	B		
Frequency range: [1GHz - 2GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Position
1956.6	54.13	Polarisation horizontale
1956.8	53.02	Polarisation verticale
1451.6	46.67	Polarisation verticale
1659.7	48.41	Polarisation verticale

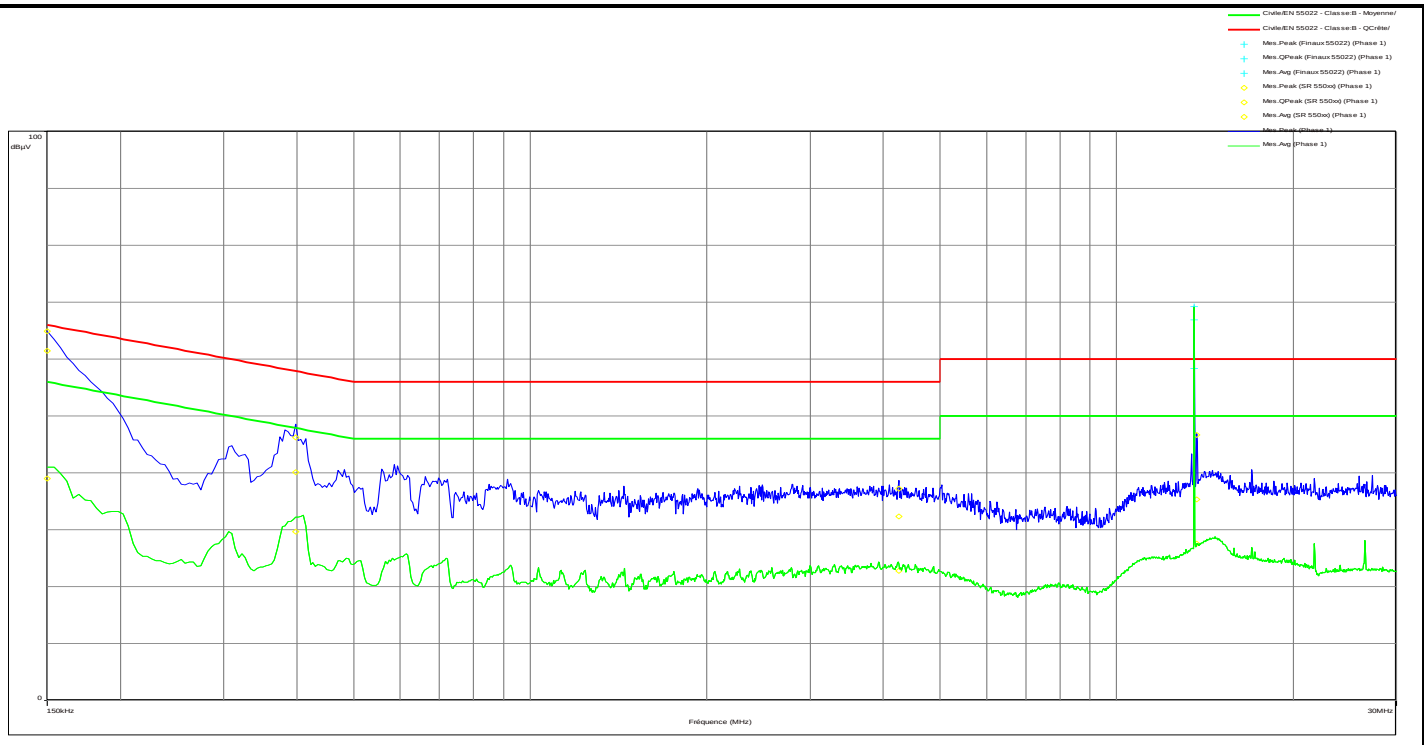
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	EN 55022	Phase	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.15	65	61.93	66	-4.07	40.23	56	-15.77
5.124	36.5	30.98	60	-29.02	21.68	50	-28.32
13.56	69.23	58.02	60	-1.98	29.42	50	-20.58
13.704	47.19	36.84	60	-23.16	25.12	50	-24.88
27.12	50.17	37.79	60	-22.21	33.66	50	-16.34

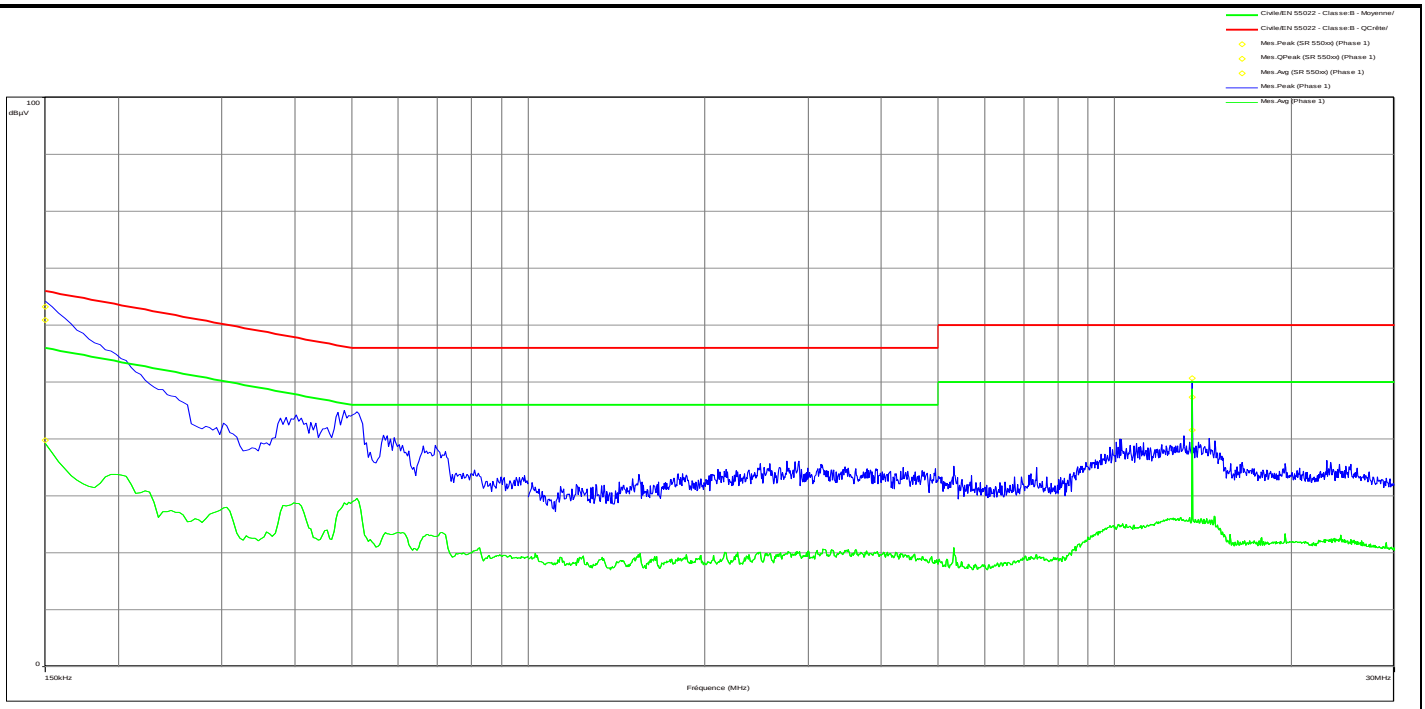
CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	EN 55022	Neutral	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Neutre	**VBW :**	30kHz



Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.15	64.89	61.49	66	-4.51	39	56	-17
0.398	46.22	40.08	57.9	-17.82	29.71	47.9	-18.18
4.248	37.18	32.38	56	-23.62	22.74	46	-23.26
13.56 *	69.28	66.92	60	6.92	58.31	50	8.31
13.704	46.7	35.38	60	-24.62	27.52	50	-22.48

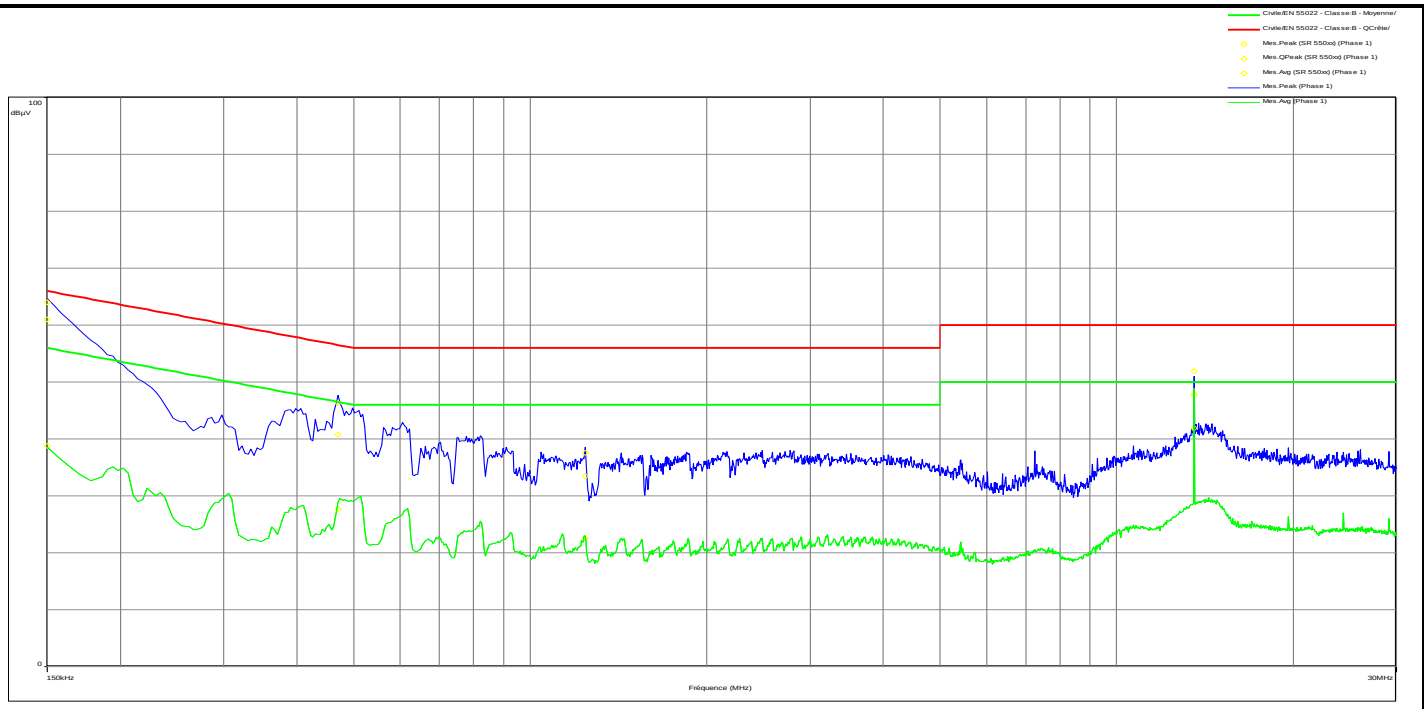
* : RFID carrier frequency

CONDUCTED EMISSIONS			
Graph name:	Emc#3	**Test configuration:**	
Limit:	EN 55022	Phase – Dummy load	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.15	63.17	60.94	66	-5.06	39.75	56	-16.25
13.56	50.66	47.37	60	-12.63	41.54	50	-8.46

CONDUCTED EMISSIONS			
Graph name:	Emc#4	**Test configuration:**	
Limit:	EN 55022	Neutral – Dummy load	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz



Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.15	64.04	60.95	66	-5.05	38.73	56	-17.27
0.47	46.38	40.73	56.51	-15.78	27.7	46.51	-18.82
1.24	37.57	33.44	56	-22.56	22.53	46	-23.47
13.56	51.85	47.79	60	-12.21	41.86	50	-8.14

9. 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 *Measurement of conducted disturbances in voltage on the power port*	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 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.*