TEST REPORT

N°: 144534-692806-A(FILE#843369) **Version : 03**

Subject	**Electromagnetic compatibility tests according to the standards:** **FCC CFR 47 Part 15, Subpart C** **RSS-210 Issue 9**
Issued to	E.M.S Electro Medical Systems S.A. Ch. De la Vuarpillère 31 1260 Nyon - Switzerland
Apparatus under test	
Product	**Intracorporeal lithotripter**
Trade mark	**EMS**
Manufacturer	**EMS**
Family	**FT-231 / FT-232 / FT-235**
Model under test	**FT-232**
Serial number	**KQ00006**
FCCID	**2ANZC-GRDLNBPVMEO**
IC	**23296-GRDLNBPVMEO**
Conclusion	See Test Program chapter
Test date	January 12, 2017 to January 27, 2017
Test location	MOIRANS
IC Test site	6500A-1
Composition of document	29 pages
Document issued on	October 19, 2017

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	May 24, 2017	Gaetan Deschamps	Creation of the document
02	July 3, 2017	Gaetan Deschamps	Modification of FCC part on EMR graphs
03	October 19, 2017	Gaetan Deschamps	Adding of FCC/IC information

SUMMARY

1. TEST PROGRAM

Standard: **- FCC Part 15, Subpart C**
- ANSI C63.10 (2013)
- RSS-210 Issue 9
- RSS-Gen Issue 4

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-25GHz* *CFR 47 §15.209 (a)* *CFR 47 §15.225* *RSS-Gen §4.9* ***Highest frequency :500MHz (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 §B.6*	**Operation within the band 13.110-14.010 MHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Fundamental frequency tolerance *CFR 47 §15.225* *RSS-210 §B.6*	**Operation within the band 13.110-14.010 MHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Band edge compliance *CFR 47 §15.225* *RSS-210 §B.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. INFORMATION

Description of trilogy product family:
FT-231: Model with pinch valve for suction feature. Radio transceiver and antenna are equivalent (hardware and software)
FT-232: Model with peristaltic pump (stepper motor) for suction feature
FT-235: Model equivalent to FT-232 with difference in color and branding on the cabinet, hand piece and graphical user interface.

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
FT-232
Serial Number: KQ00006

Power supply:
During all the tests, EUT is supplied by V_{nom}: 120VAC
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	☑ AC ☐ DC ☐ Battery	100-240VAC, 50-60Hz, 500VA & IP21	-	-

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	AC	2	☐	☐	☑	-
Access1	PEDAL	6	☐	☑	☑	-
Access2	HDMI	10	☐	☑	☑	-
Access3	EN-075	3	☐	☐	☑	-
Access4	USB	-	☐	☐	☐	Maintenance only
Access5	USB	-	☐	☐	☐	Maintenance only
Access6	RJ45	-	☐	☐	☐	Maintenance only
Access7	SERIAL PORT	-	☐	☐	☐	Maintenance only
Access8	EARTH EQUIPOTENTIAL	-	☐	☐	☐	Not linked

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Probe	FR-245	-	-
TV	LG	-	-

Equipment information:

Frequency band:	☑ [13.553–13.567]MHz	☐ [125]kHz	☐ [-] MHz	
RF mode:	☐ Transmitter	☑ Transceiver	☐ Receiver	☐ Standby
Type:	☑ RFID	☐ EAS	☐ Other:	
Bandwidth:	☐ Narrowband (ISO15693, ISO18000-3…)		☑ Wideband (ISO14443, NFC…)	
Channelized system:	☑ No	☐ Yes, channel spacing: kHz		
Equipment intended for use as a	☑ Fixed	☐ Mobile	☐ Portable	

Type of equipment:	☑ Stand-alone	☐ Plug-in	☐ Combined	
Antenna Type:	☐ External		☑ Internal	
Antenna connector:	☐ Permanent external	☐ Permanent internal	☑ None	☐ Temporary (only for tests)
Antenna Gain:	0dBi			
Duty cycle:	☑ Continuous duty	☐ Intermittent duty	☐ Continuous operation	
Equipment type:	☑ Production model		☐ Prototype	
Temperature range*: *Customer request	Tmin:	☐ -20°C	☐ 0°C	☑ 10 °C
	Tnom:	20°C		
	Tmax:	☐ 35°C	☐ 55°C	☑ 30 °C
Type of power source:	☑ AC power supply	☐ DC power supply	☐ Battery (Select type)	
Test source voltage:	Vmin:	☐ 207V/50Hz	☑ 108 VDC	
	Vnom:	☐ 230V/50Hz	☑ 120 VDC	
	Vmax	☐ 253V/50Hz	☑ 132 VDC	

2.3. EUT CONFIGURATION

Module RF: TAGSYS MEDIO P232
Firmware / Software version of EUT:
ES-078 LDR 0.2.3
ES-079 LDR 0.2.23 NEW_HP
ES-080 LDR 0.1.19

For conducted and radiated emission data:

- - Normal utilization of EUT. Pump (water) and probe (RF) is actived. The EUT simulates all utilization configurations in a time of 1s. The data is displayed on LG TV by HDMI cable with a resolution 640x480

2.4. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

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 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.

2.6. 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	:	January 20, 2017
Test performed by	:	Jonathan Sarto
Atmospheric pressure (hPa)	:	1000
Relative humidity (%)	:	32
Ambient temperature (°C)	:	22

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.

3.3. TEST METHOD

The product has been tested according to ANSI C63.10 and FCC Part 15 subpart C. The product has been tested with 120V/60Hz power line voltage and compared to the FCC Part 15 limits. 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	04/16	04/17
EMC comb generator	LCIE SUD EST	-	A3169098	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320291	12/16	12/17
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	08/16	08/17
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206022	08/16	08/17
Transient limiter	HEWLETT PACKARD	11947A	A4049061	02/16	02/17

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 FT-232, Sn: KQ00006, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C, for conducted emissions.

4. RADIATED EMISSION DATA (15.209)

4.1. ENVIRONMENTAL CONDITIONS

Date of test	:	January 20, 2017
Test performed by	:	Jonathan Sarto
Atmospheric pressure (hPa)	:	1000
Relative humidity (%)	:	32
Ambient temperature (°C)	:	22

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}.

4.3. TEST METHOD

The product has been tested according to ANSI C63.10, FCC Part 15 Subpart C.
Pre-characterisation measurement: (9kHz – 6GHz)
A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz to 6GHz. 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 6GHz.

Characterization on 10 meters open site from 9kHz to 1GHz:
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 limits. 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 6GHz:
The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC Part 15 Subpart C limits. Measurement bandwidth was 1MHz from 1GHz to 6GHz. 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.

NOTE: Equipment is, for digital circuitry, under FCC Part15B Class A, so until 10th harmonic of 13.56MHz, limit of FCC Part15C are used only for spurious from RF part.

4.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Bi-log	CHASE	CBL6111A	C2040051	06/16	06/18
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/15	11/17
Antenna Bi-log	CHASE	CBL6111A	C2040172	06/16	06/18
Cable Measure @3m 18GHz	-	-	A5329038	10/16	10/17
Cable substitution (OATS)	-	-	A5329059	05/16	05/17
Cable Measure @3m	-	-	A5329206	04/16	04/17
Cable (OATS)	-	-	A5329623	01/16	01/17
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	03/16	03/19
Radiated emission comb generator	BARDET	-	A3169050	-	-
OATS	-	-	F2000409	08/16	08/17
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	08/16	08/17
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	08/16	08/17
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/16	10/17
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206022	08/16	08/17
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
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	MATURO Gmbh	-	F2000437	-	-
Table	LCIE	-	F2000461	-	-
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444	-	-
Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447D	A7085008	12/16	12/17
Amplifier 1-13GHz	LCIE SUD EST	-	A7102067	04/16	04/17
Antenna Bi-Log	AH System	SAS-521-7	C2040180	07/16	07/18
Cable	-	-	A5329065	03/16	03/17
Cable	MICRO-COAX	-	A5329657	04/16	04/17
Cable	MICRO-COAX	-	A5329658	05/16	05/17
Semi-Anechoic chamber #1	SIEPEL	-	D3044016	06/16	06/17
Radiated emission comb generator	BARDET	-	A3169050	-	-
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088	-	-
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A4060049	02/16	02/18
Turntable chamber (Cage#1)	MATURO Gmbh	TT 2.0 SI	F2000406	-	-
Antenna mast (Cage#1)	MATURO Gmbh	AM 4.0	F2000407	-	-
Turntable controller (Cage#1)	MATURO Gmbh	Control Unit	F2000408	-	-
Table	MATURO Gmbh	-	F2000437	-	-

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°/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# 2	H/V	Axis XY	-	See annex 1

4.6.3. Pre-characterization at 3 meters [1GHz-6GHz]

See graphs for 1GHz-6GHz:

Graph identifier	Polarization	EUT position	Comments	
Emr# 3	H/V	Axis XY	-	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	84.0	28.1	**-55.9**	280	0°	100		
2	27.12	29.5	7.1	**-22.4**	230	0°	100		

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

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.

Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Gain/Loss Factor (dB)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
40.680	19.8	QP	V	60	100	-	14.3	34.1	40.0	-5.9
54.240	25.9	QP	H	250	100	-	8.4	34.3	40.0	-5.7
67.800	24.3	QP	V	270	100	-	7.7	32.0	40.0	-8.0
81.360	25.0	QP	V	360	300	-	8.9	33.9	40.0	-6.1
203.400	30.1	QP	H	200	380	-	11.8	41.9	43.5	-1.6

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

Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Gain/Loss Factor (dB)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.200	21.4	QP	V	120	100	-	19.8	41.2	49.6	-8.4
34.700	25.0	QP	V	50	100	-	17.2	42.2	49.6	-7.4
50.300	27.2	QP	V	270	100	-	9.4	36.6	49.6	-13.0
55.800	39.5	QP	V	360	100	-	8.4	47.9	49.6	-1.7
66.800	34.1	QP	V	325	190	-	7.8	41.9	49.6	-7.7
135.800	25.5	QP	V	0	100	-	13.8	39.3	54.0	-14.7
157.400	26.4	QP	V	160	100	-	12.9	39.3	54.0	-14.7
173.500	26.7	QP	V	100	100	-	12.1	38.8	54.0	-15.2
191.000	22.3	QP	V	0	100	-	11.4	33.7	54.0	-20.3
352.000	29.2	QP	V	280	400	-	18.3	47.5	56.9	-9.4
377.120	28.5	QP	V	280	400	-	19.2	47.7	56.9	-9.2
402.300	29.0	QP	V	290	380	-	20.0	49.0	56.9	-7.9
574.500	16.6	QP	H	170	100	-	24.1	40.7	56.9	-16.2
603.400	31.5	QP	V	0	310	-	24.7	56.2	56.9	-0.7

4.6.6. Characterization on 3meters anechoic chamber from 1GHz to 6GHz

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 significant frequency observed.
Note: Measures have been done at 3m distance.

4.7. CONCLUSION

The sample of the equipment FT-232, Sn: KQ00006, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C, for radiated emissions.

5. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)

5.1. ENVIRONMENTAL CONDITIONS

Date of test : January 25, 2017
Test performed by : Gaëtan DESCHAMPS
Atmospheric pressure (hPa) : 1002
Relative humidity (%) : 21
Ambient temperature (°C) : 31

5.2. TEST SETUP

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

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 85% to 115% of the rated supply voltage at 20°C.

5.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/15	11/17
Cable SMA	-	18G	A5329373	12/16	12/17
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	08/16	08/17
RSCommander	R&S	v1.6.4	L1000116	-	-
Thermometer (radio)	FLUKE	52 II	B4043150	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206022	08/16	08/17
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	01/00	

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

5.6. TEST RESULTS

Temperature / Voltage	10°C*	20°C	+30°C*
Mains voltage: 120V/60Hz			
Frequency Drift (MHz)	+ 0.000061	**13.559962**	- 0.000003
Carrier level (dBc)	- 0.89	**28.10**	+ 0.45
Mains voltage: 108V/60Hz			
Frequency Drift (MHz)	+ 0.000058	+ 0.000000	- 0.000003
Carrier level (dBc)	+ 0.67	+ 0.04	- 0.83

Mains voltage: 132V/60Hz Frequency Drift (MHz) Carrier level (dBc)	 + 0.000052 + 0.70	 - 0.000003 + 0.08	 - 0.000003 + 0.40

*Utilization range of equipment (requirement customer).

Frequency drift measured is 61**Hz** when the temperature is varied from 10°C to +30°C and voltage is varied.

5.7. CONCLUSION

The sample of the equipment FT-232, Sn: KQ00006, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C, for fundamental frequency tolerance.

6. BAND-EDGE COMPLIANCE §15.209

6.1. ENVIRONMENTAL CONDITIONS

Date of test : January 25, 2017
Test performed by : Gaëtan DESCHAMPS
Atmospheric pressure (hPa) : 1002
Relative humidity (%) : 21
Ambient temperature (°C) : 31

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.

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

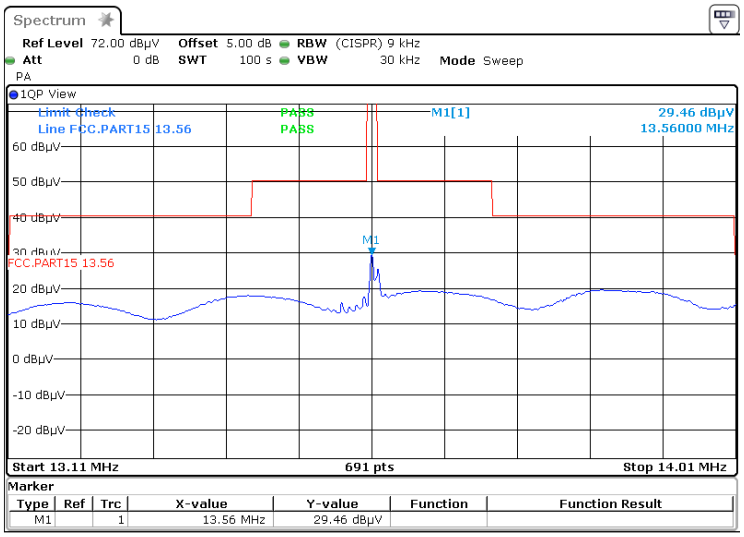
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/15	11/17
Cable SMA	-	18G	A5329373	12/16	12/17
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	08/16	08/17
RSCommander	R&S	v1.6.4	L1000116	-	-
Thermometer (radio)	FLUKE	52 II	B4043150	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206022	08/16	08/17
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	01/00	

6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

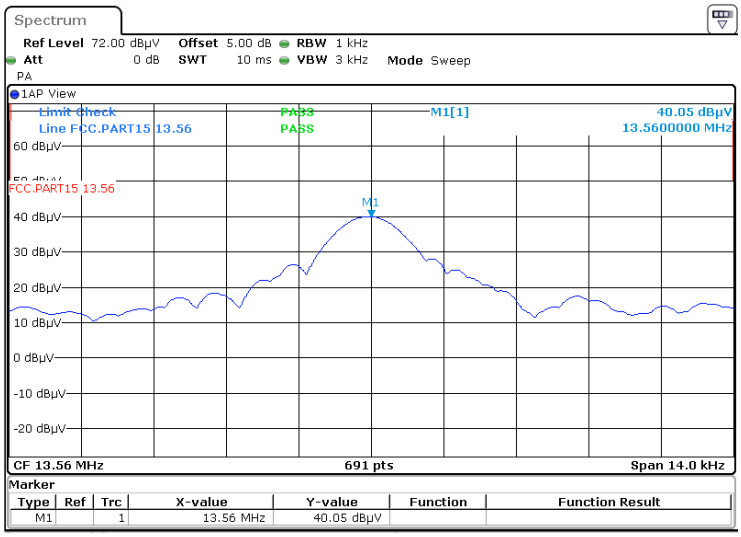
☑ None ☐ Divergence:

6.6. TEST RESULTS

Frequency band 13.110-14.010MHz



Frequency band 13.553-13.567MHz



6.7. CONCLUSION

The sample of the equipment FT-232, Sn: KQ00006, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C, for band-edge compliance.

7. OCCUPIED BANDWIDTH

7.1. ENVIRONMENTAL CONDITIONS

Date of test : January 25, 2017
Test performed by : Gaëtan DESCHAMPS
Atmospheric pressure (hPa) : 1002
Relative humidity (%) : 21
Ambient temperature (°C) : 31

7.2. TEST 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.

☑ ***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 in the range of 1% to 5% of the anticipated emission bandwidth
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

7.3. TEST EQUIPMENT LIST

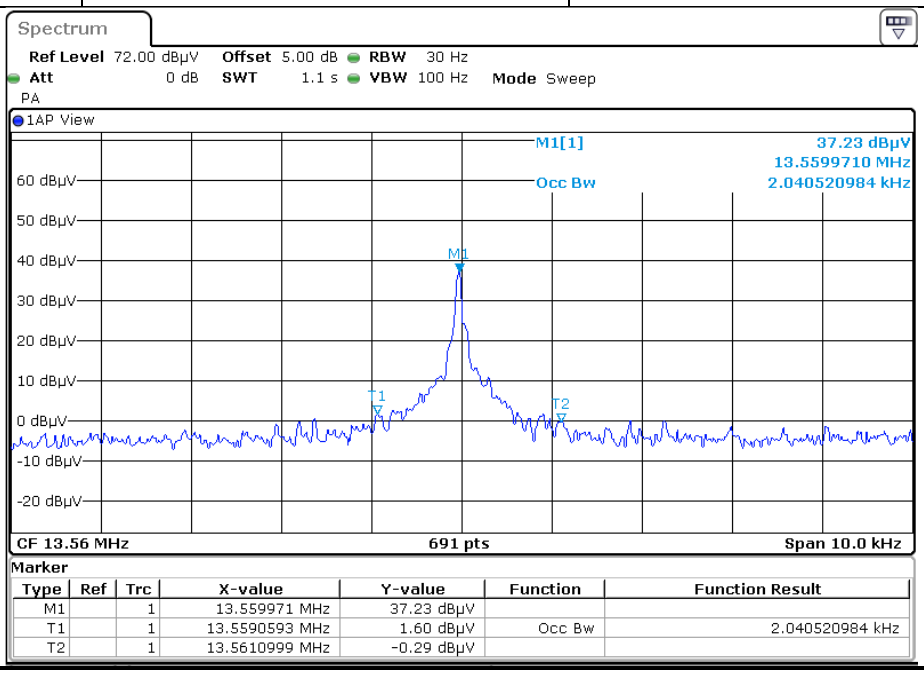
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/15	11/17
Cable SMA	-	18G	A5329373	12/16	12/17
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	08/16	08/17
RSCommander	R&S	v1.6.4	L1000116	-	-
Thermometer (radio)	FLUKE	52 II	B4043150	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206022	08/16	08/17
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	01/00	

7.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

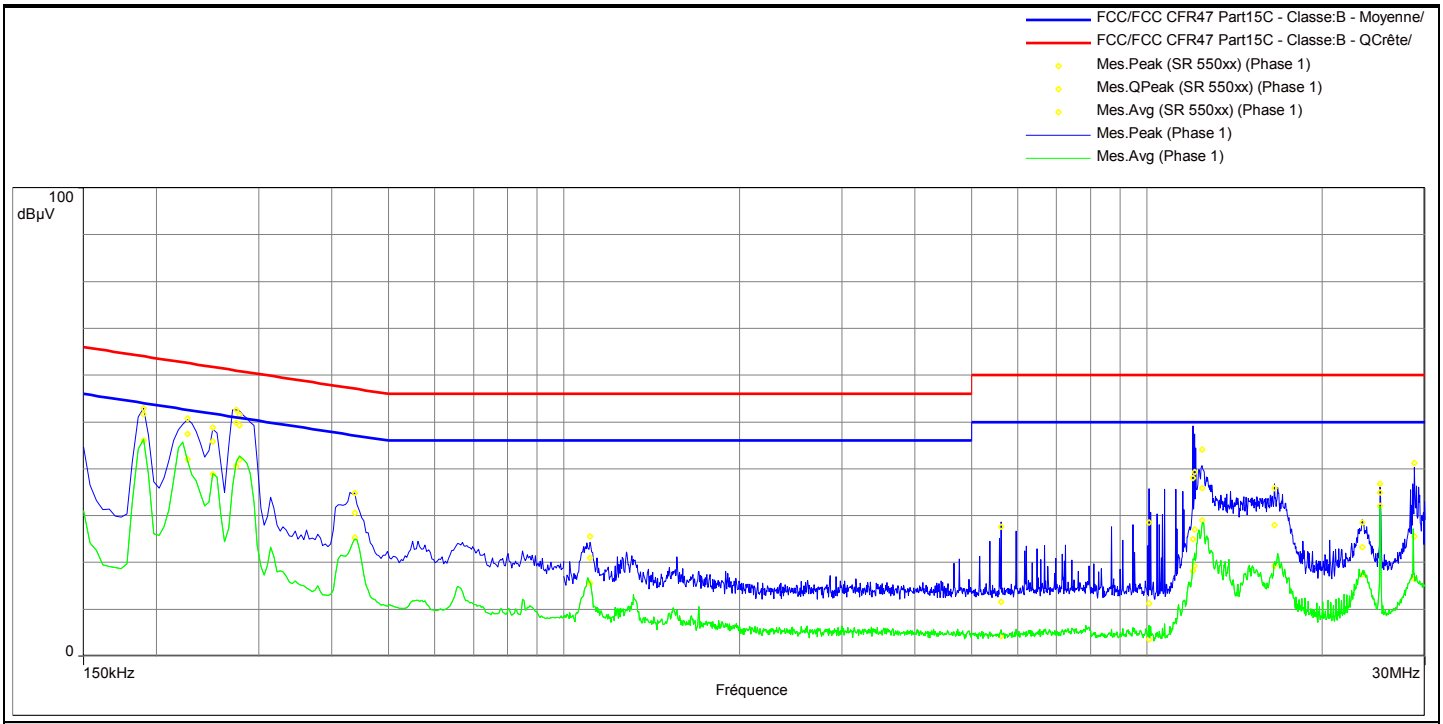
7.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (kHz)
Nom	13.56	**2.04**



8. ANNEX 1 (GRAPHS)

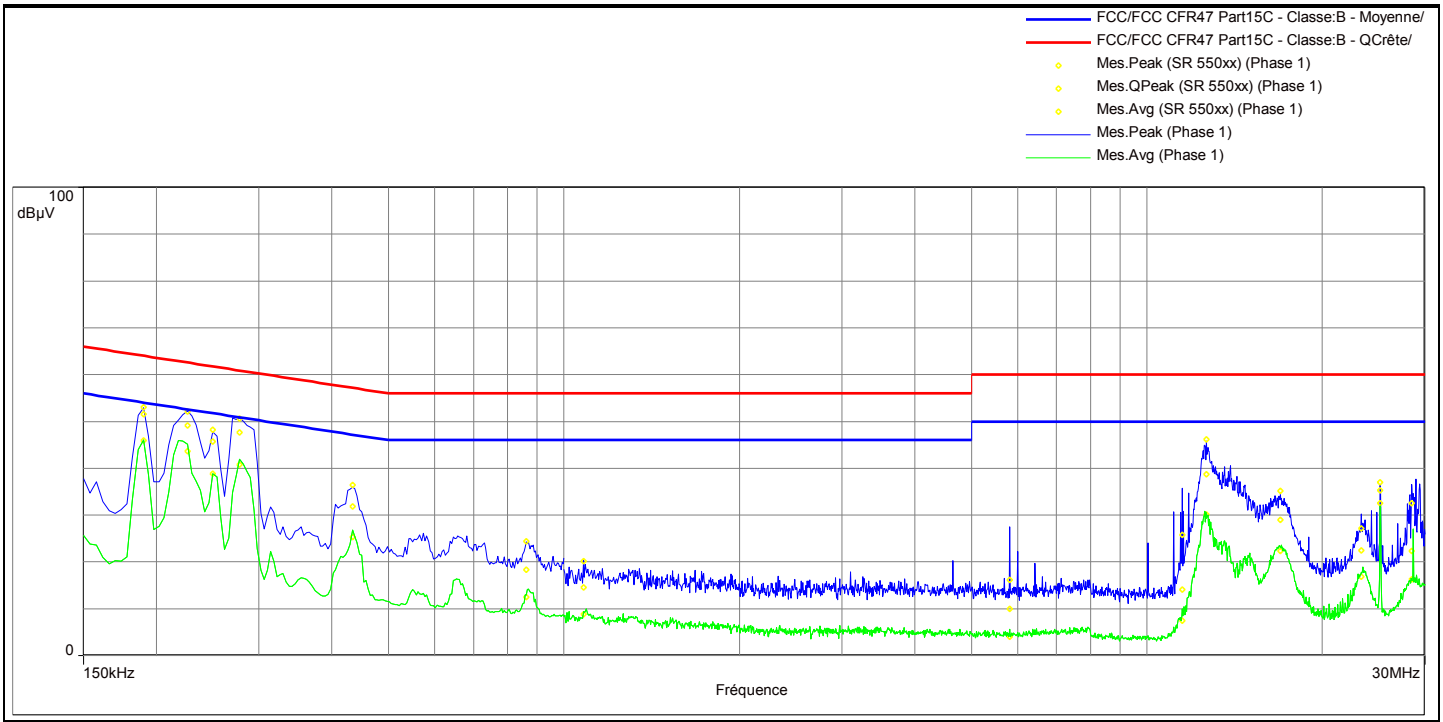
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	EN 55022	Phase 120V/60Hz	
Class:	A		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



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)
0.190	52.90	51.64	64.04	-12.40	46.04	54.04	-8.00
0.226	50.75	47.43	62.60	-15.16	42.03	52.60	-10.56
0.250	48.79	45.80	61.76	-15.96	38.89	51.76	-12.86
0.274	52.57	49.83	61.00	-11.16	40.56	51.00	-10.43
0.278	51.56	49.25	60.88	-11.62	41.92	50.88	-8.96
0.438	34.82	30.64	57.10	-26.46	25.32	47.10	-21.78
1.108	25.59	20.93	56.00	-35.07	15.58	46.00	-30.42
5.624	27.67	11.57	60.00	-48.43	4.26	50.00	-45.74
10.092	28.50	11.28	60.00	-48.72	3.61	50.00	-46.39
11.992	38.07	25.01	60.00	-34.99	18.27	50.00	-31.73
12.084	39.26	27.07	60.00	-32.93	19.30	50.00	-30.70
12.436	44.09	35.87	60.00	-24.13	28.94	50.00	-21.06
16.560	35.84	27.95	60.00	-32.05	19.20	50.00	-30.80
23.432	28.52	23.20	60.00	-36.80	17.40	50.00	-32.60
25.140	36.74	34.91	60.00	-25.09	32.10	50.00	-17.90
28.772	41.24	25.61	60.00	-34.39	16.53	50.00	-33.47

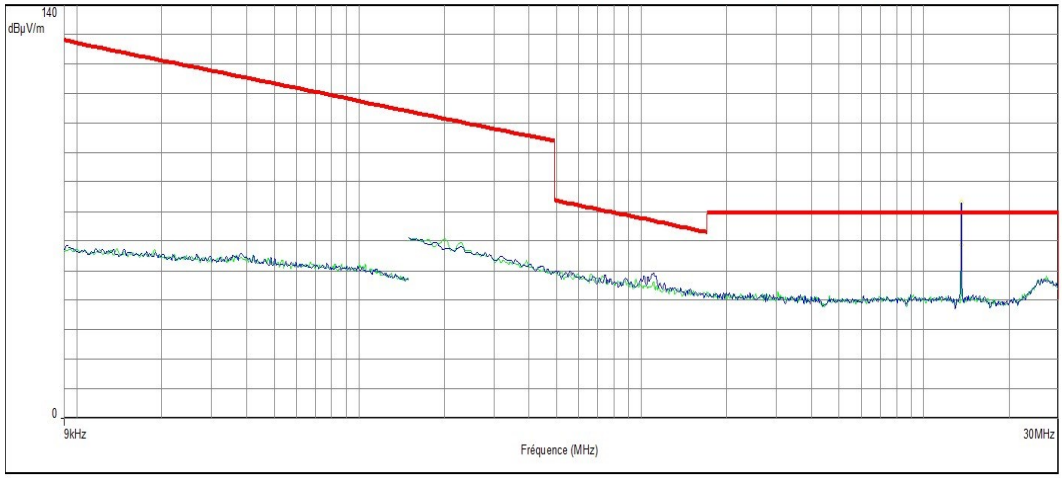
CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	EN 55022	Neutral 120V/60Hz	
Class:	A		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC / 60Hz	**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz



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)
0.190	53.01	51.57	64.04	-12.47	45.91	54.04	-8.13
0.226	52.08	49.13	62.60	-13.47	43.65	52.60	-8.94
0.250	48.27	45.67	61.76	-16.09	38.84	51.76	-12.91
0.278	50.65	47.61	60.88	-13.27	40.84	50.88	-10.04
0.434	36.43	31.81	57.18	-25.36	25.31	47.18	-21.87
0.862	24.41	18.30	56.00	-37.70	12.55	46.00	-33.45
1.080	20.18	14.55	56.00	-41.45	8.84	46.00	-37.16
5.816	16.20	9.99	60.00	-50.01	4.05	50.00	-45.95
11.492	25.81	14.07	60.00	-45.93	7.46	50.00	-42.54
12.644	46.14	38.76	60.00	-21.24	30.15	50.00	-19.85
16.928	35.12	29.03	60.00	-30.97	22.34	50.00	-27.66
23.348	27.17	22.49	60.00	-37.51	16.79	50.00	-33.21
25.140	37.03	35.31	60.00	-24.69	32.55	50.00	-17.45
28.460	32.49	22.29	60.00	-37.71	16.22	50.00	-33.78

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(0°/90°) - Configuration 1 - Axis XY < 30MHz	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz

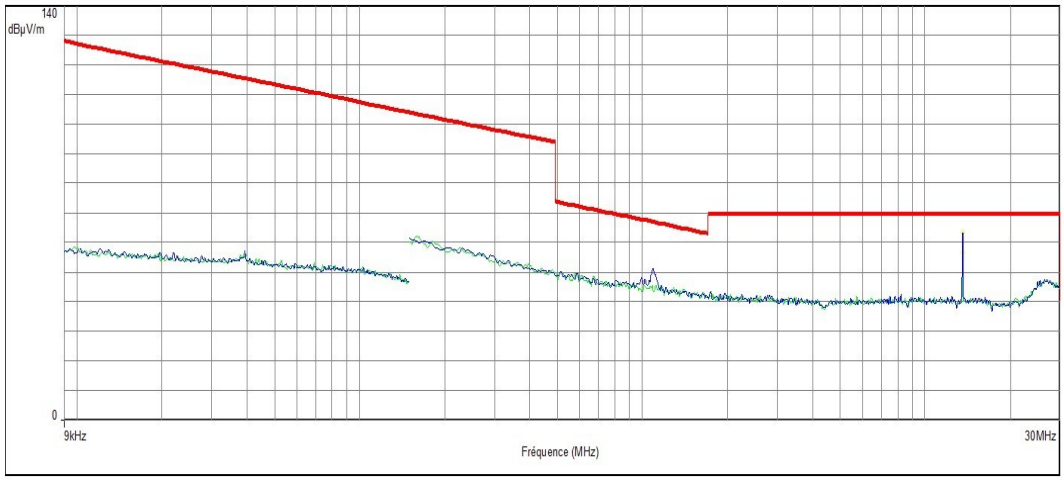


Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Polarization
13.559*	72.8	69.5	3.3	Horizontal
13.559*	58.6	69.5	-10.9	Vertical

*Carrier frequency

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(0°/90°) - Configuration 1 - Axis Z < 30MHz	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz

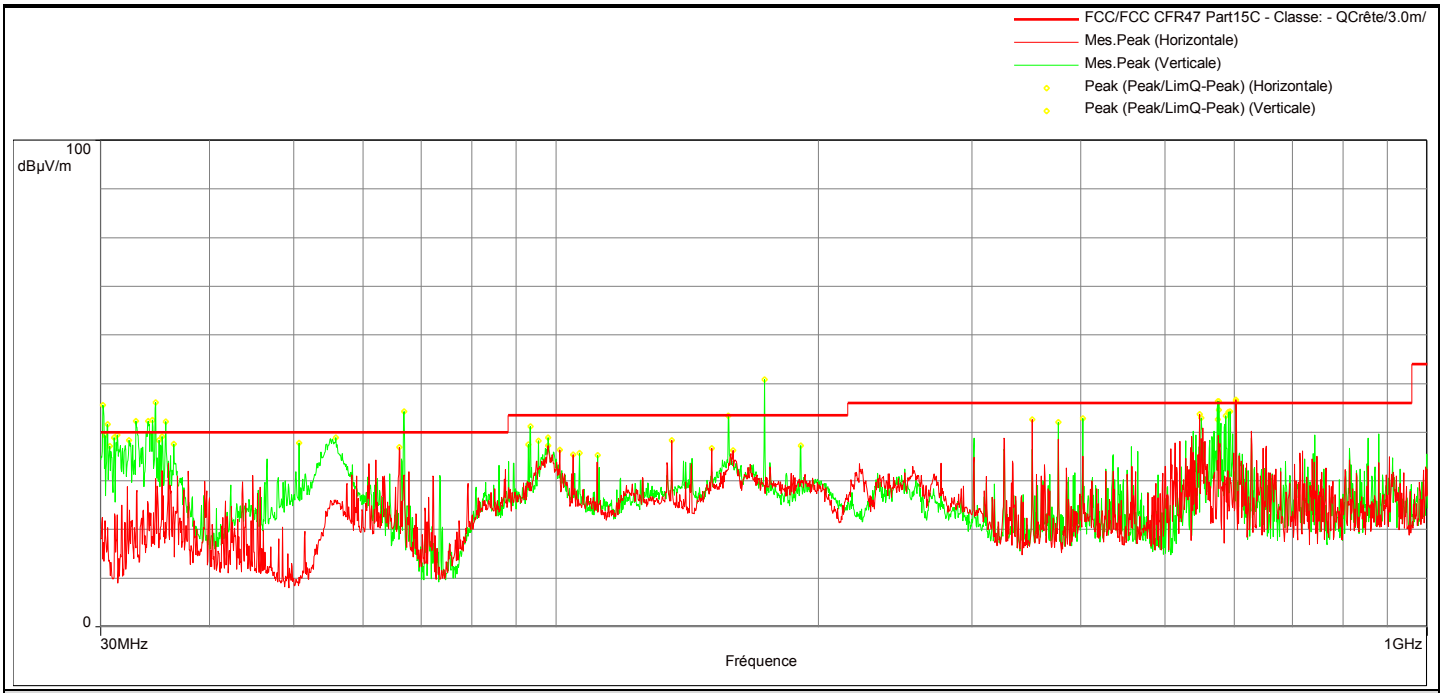


Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Polarization
13.559*	63.4	69.5	-6.1	Horizontal
13.562*	56.8	69.5	-12.7	Vertical

*Carrier frequency

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

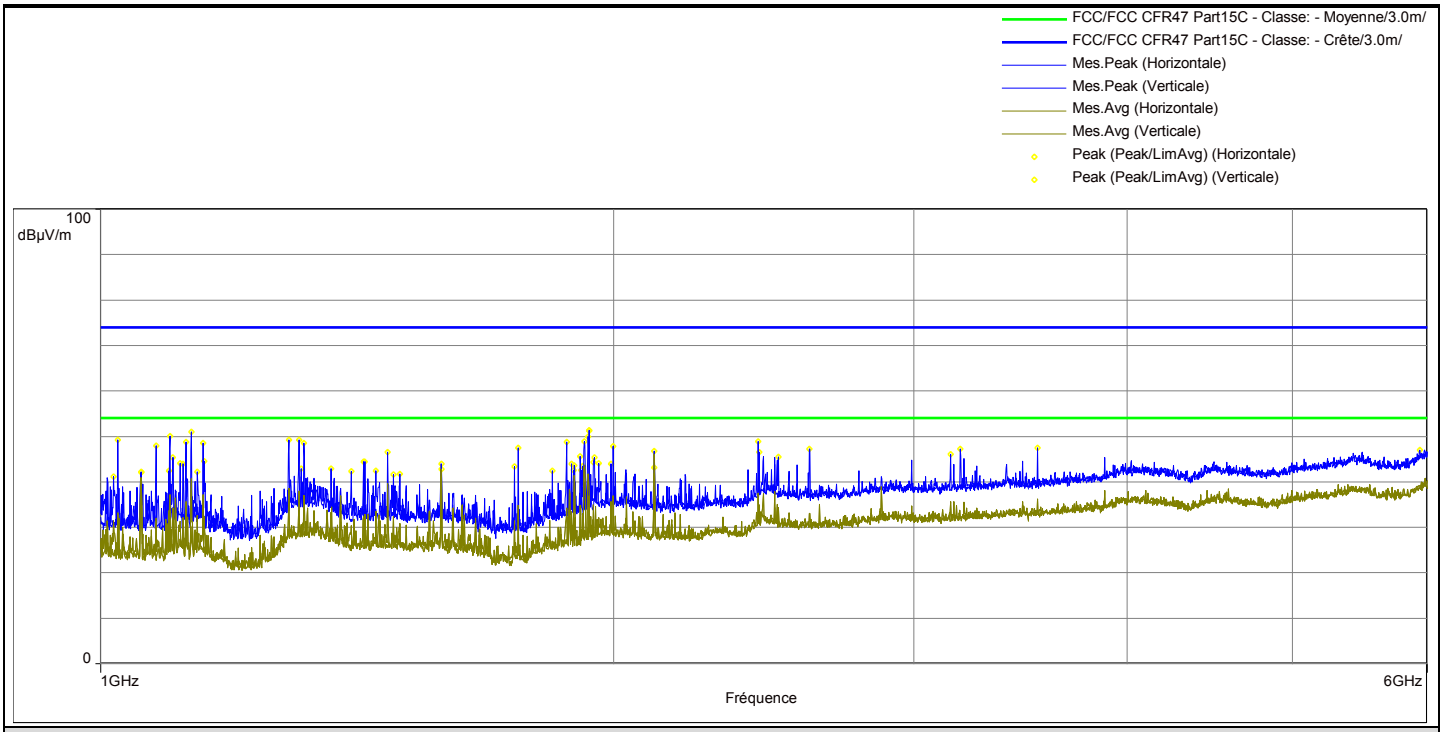


Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Polarization
66.091	36.9	Horizontal
97.830	37.2	Horizontal
100.958	36.4	Horizontal
104.528	35.4	Horizontal
135.791	38.4	Horizontal
150.921	36.7	Horizontal
159.659	36.3	Horizontal
351.960	42.6	Horizontal
548.080	43.7	Horizontal
603.360	46.7	Horizontal
30.170	45.6	Vertical
30.323	39.3	Vertical
30.544	41.7	Vertical
30.731	37.1	Vertical
31.088	38.9	Vertical
31.360	39.4	Vertical
32.346	38.3	Vertical
32.941	42.3	Vertical
33.995	42.2	Vertical
34.420	42.5	Vertical
34.675	46.1	Vertical
34.998	38.3	Vertical
35.270	39.1	Vertical
35.644	42.1	Vertical
36.409	37.6	Vertical

Frequency (MHz)	Peak (dBµV/m)	Polarization
50.706	37.8	Vertical
55.840	38.9	Vertical
66.873	44.2	Vertical
92.866	37.5	Vertical
93.376	41.1	Vertical
95.450	38.2	Vertical
97.847	38.8	Vertical
106.330	35.7	Vertical
111.583	35.3	Vertical
157.670	43.4	Vertical
173.463	50.8	Vertical
190.803	37.2	Vertical
377.120	42.1	Vertical
402.280	42.8	Vertical
550.320	42.9	Vertical
574.320	46.4	Vertical
574.920	42.6	Vertical
576.320	46.3	Vertical
576.680	44.6	Vertical
587.160	43.4	Vertical
591.560	44.2	Vertical
593.520	44.3	Vertical
603.360	46.4	Vertical

RADIATED EMISSIONS			
Graph name:	Emr#4	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Emr>1GHz	
Class:	-		
Frequency range: [1GHz - 6GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Polarization
1056.000	42.2	Horizontal
1077.750	48.0	Horizontal
1096.750	42.4	Horizontal
1289.250	49.2	Horizontal
1307.250	49.3	Horizontal
1316.000	48.6	Horizontal
1450.000	42.4	Horizontal
1473.500	46.6	Horizontal
1485.500	41.6	Horizontal
1584.000	42.8	Horizontal
1748.500	43.3	Horizontal
1757.500	47.5	Horizontal
1841.000	42.4	Horizontal
1876.000	48.7	Horizontal
1894.500	42.5	Horizontal
1913.000	42.6	Horizontal
1922.250	48.9	Horizontal
1932.000	49.9	Horizontal
1959.750	44.1	Horizontal
2112.000	43.2	Horizontal
2430.500	48.9	Horizontal
2605.000	47.3	Horizontal
3194.000	47.2	Horizontal
5938.500	47.1	Horizontal

Frequency (MHz)	Peak (dBµV/m)	Polarization
1017.250	41.2	Vertical
1023.250	49.3	Vertical
1056.000	42.0	Vertical
1098.000	50.0	Vertical
1102.500	45.4	Vertical
1113.500	44.1	Vertical
1117.500	44.0	Vertical
1122.000	48.8	Vertical
1130.000	51.0	Vertical
1139.500	42.2	Vertical
1148.250	48.5	Vertical
1150.000	44.6	Vertical
1311.000	42.9	Vertical
1364.750	42.9	Vertical
1402.500	42.4	Vertical
1426.250	44.5	Vertical
1428.750	44.4	Vertical
1498.000	41.8	Vertical
1584.000	43.9	Vertical
1888.500	43.9	Vertical
1896.000	43.6	Vertical
1911.000	45.6	Vertical
1917.250	43.6	Vertical
1933.500	51.2	Vertical
1934.250	51.4	Vertical
1945.750	44.4	Vertical
1947.750	45.3	Vertical
1992.250	44.0	Vertical
1998.000	47.9	Vertical
2112.000	46.8	Vertical
2434.500	46.5	Vertical
2497.500	45.5	Vertical
3151.000	46.1	Vertical
3543.500	47.5	Vertical

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*	3.51 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.*	3.26 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension *Measurement of discontinuous conducted disturbances in voltage*	3.45 dB	3.6 dB
Mesure des perturbations conduites en courant *Measurement of conducted disturbances in current*	3.09 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*	5.20 dB	6.3 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.*