Release July, 2017

TEST REPORT

N°: 152226-713631-A (FILE#981040) **Version : 02**

Subject	**Electromagnetic compatibility tests according to the standards:** **FCC CFR 47 Part 15, Subpart C** **RSS-210 Issue 9**
Issued to	**JOLLIET INNOVATION** Rue du pommier 39100 - GEVRY France
Apparatus under test	
↳ Product	RFID reader
↳ Trade mark	**JOLLIET INNOVATION**
↳ Manufacturer	**JOLLIET INNOVATION**
↳ Model under test	**JI6-200**
↳ Serial number	**None**
↳ FCCID	**2AOI2-JI6200**
↳ IC	**23449-JI6200**
Conclusion	See Test Program chapter
Test date	December 4, 2017 to December 6, 2017
Test location	MOIRANS
IC Test site	6500A-1
Composition of document	30 pages
Document issued on	December 22, 2017

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	December 14, 2017	Majid Mourzagh	Creation of the document
02	December 22, 2017	Majid Mourzagh	Adding information for FCC

SUMMARY

1. TEST PROGRAM

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

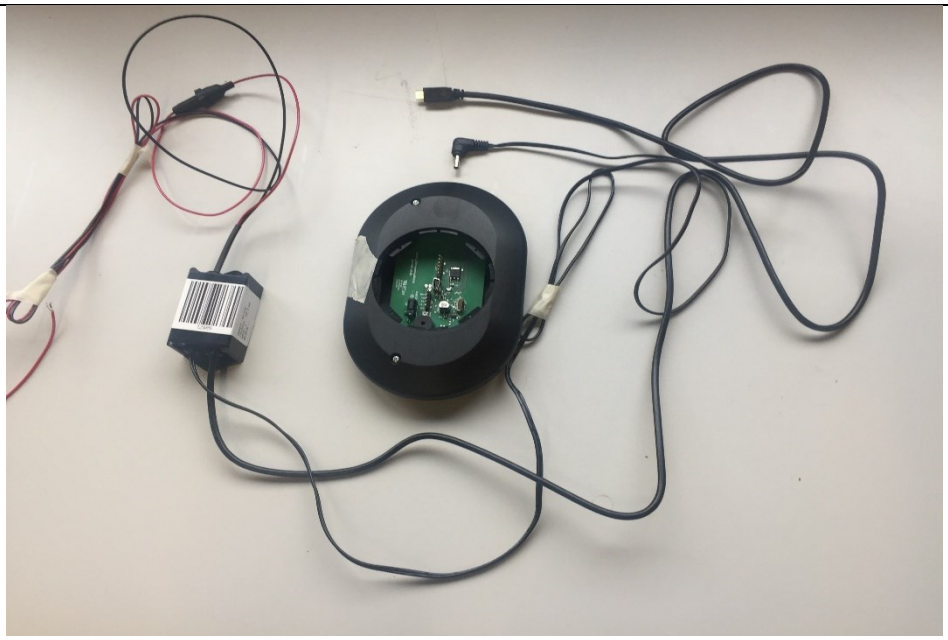
EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance at mains ports 150kHz-30MHz *CFR 47 §15.207*	**Frequency**	**Quasi-peak value (dBµV)**	**Average value (dBµV)**	☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 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 : <108MHZ (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. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
JI6-200
Serial Number: None



Photography of EUT

Power supply:
During all the tests, EUT is supplied by 20VDC
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply Input	☐ AC ☑ DC ☐ Battery	10-35VDC	12889	/

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply Input	2 wires	1.6m	☑	☐	☑	
Supply output	Jack connector 2 wires	1.35	☑	☐	☑	
MicroUSB	USB	1.5	☑	☑	☑	

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Battery Wurth elctronik	XD1350	Input DC 5V	-
SmartPhone Samsung	S7	-	-
Power supply	SODIELEC	N°LCIE: A7040058	Type SDRI 205

Equipment information:

Frequency band:	☑ [13.553–13.567]MHz	☐ [125]kHz	☐ [-] MHz	
Channel :	13.56MHz, nominal channel			
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:	Nc dBi			
Duty cycle :	☑ Continuous duty	☐ Intermittent duty	☐ Continuous operation	
Equipment type :	☑ Production model		☐ Prototype	
Temperature range :	Tmin :	☑ -30°C	☐ 0°C	☐ °C
	Tnom :	20°C		
	Tmax :	☐ 35°C	☑ 55°C	☐ °C
Type of power source :	☐ AC power supply	☑ DC power supply	☐ Battery (Select type)	
Test source voltage :	Vmin :	☐ 207V/50Hz	☑ 20.4 VDC	
	Vnom :	☐ 230V/50Hz	☑ 24 VDC	
	Vmax	☐ 253V/50Hz	☑ 27.5 VDC	

Nc: Not communicated

2.2. EUT CONFIGURATION

Firmware / Software: v6.12
Configuration mode: RFID only

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

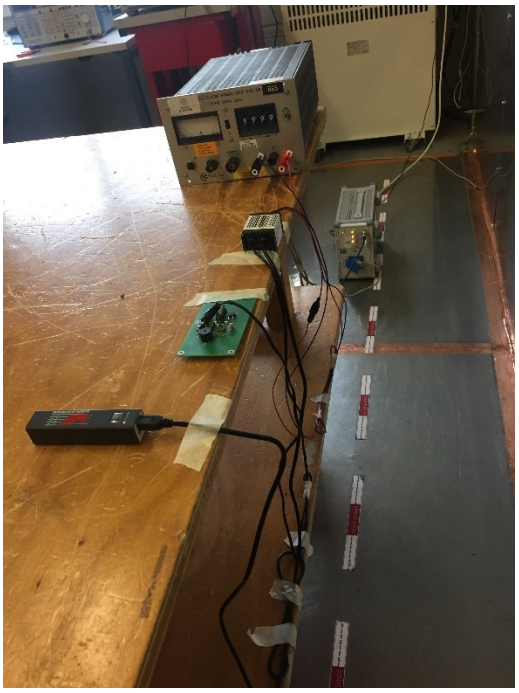
Date of test	:	December 6, 2017
Test performed by	:	Majid Mourzagh
Atmospheric pressure (hPa)	:	1001
Relative humidity (%)	:	39
Ambient temperature (°C)	:	23

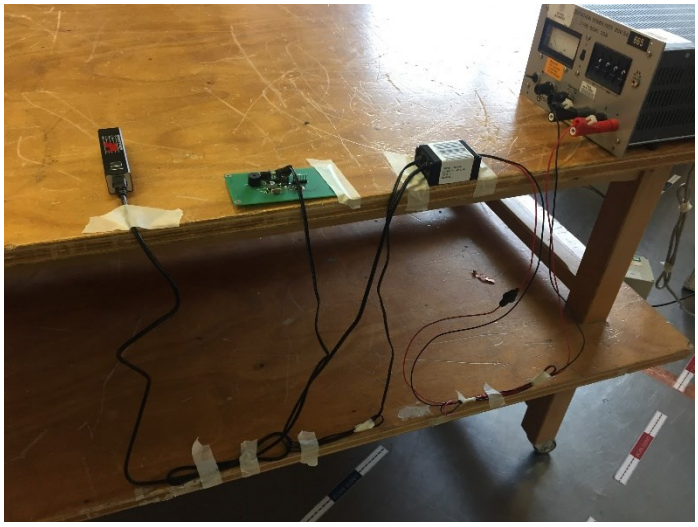
3.2. TEST SETUP

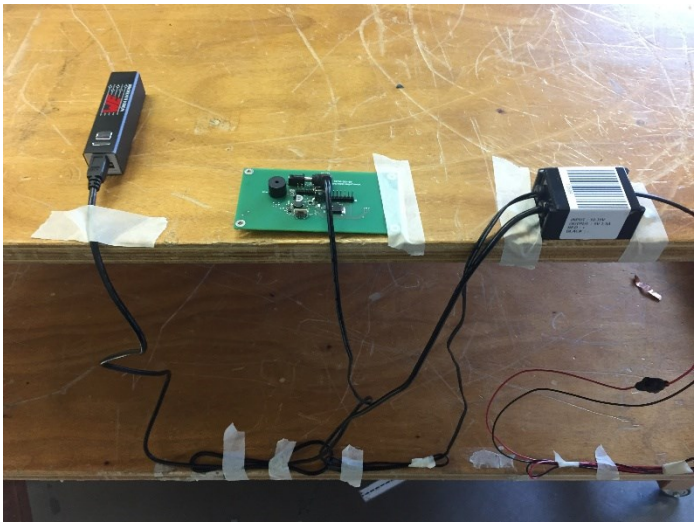
Mains terminals

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 20VDC.
The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.







Test setup

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	-	-	A5329578	02/17	02/18
EMC comb generator	LCIE SUD EST	-	A3169098	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320291	12/16	12/17
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	08/17	08/18
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204	01/17	01/18

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

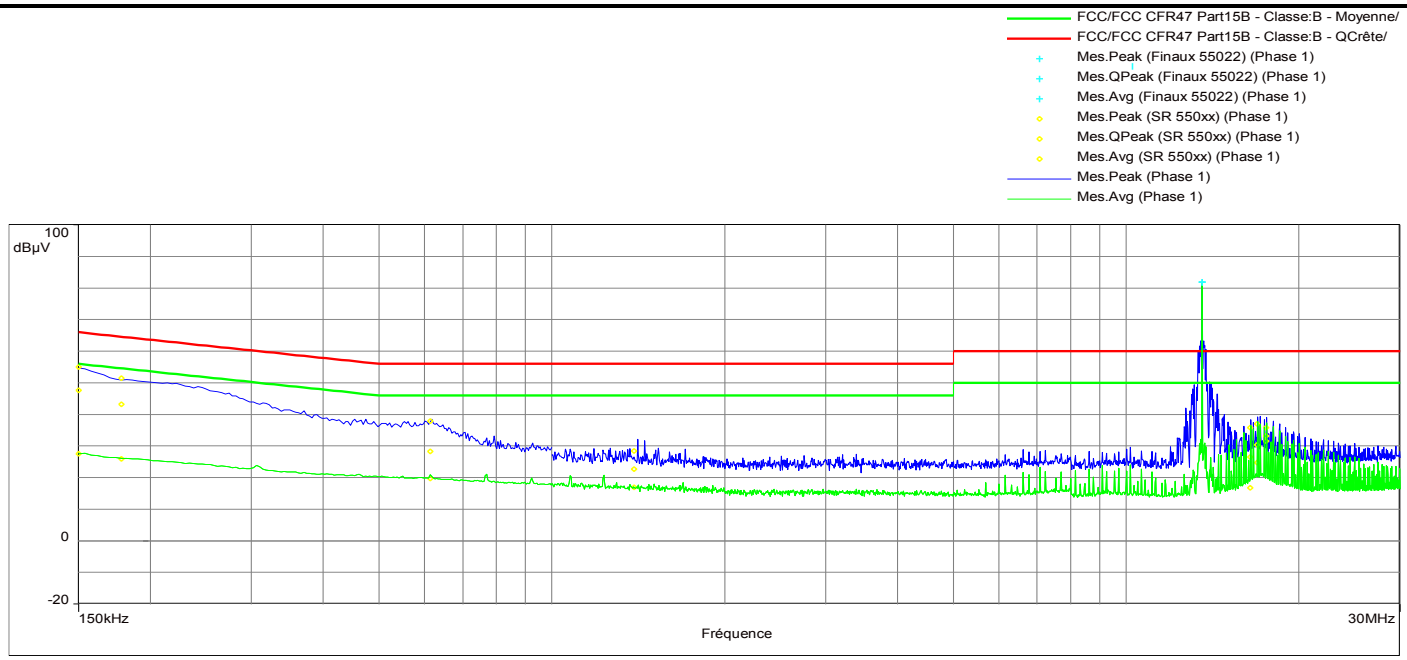
3.6. TEST RESULTS

Mains terminals:

Supply Input
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 graph
Emc#	2	Neutral	-	See graph

CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	L1 - J5-210	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz

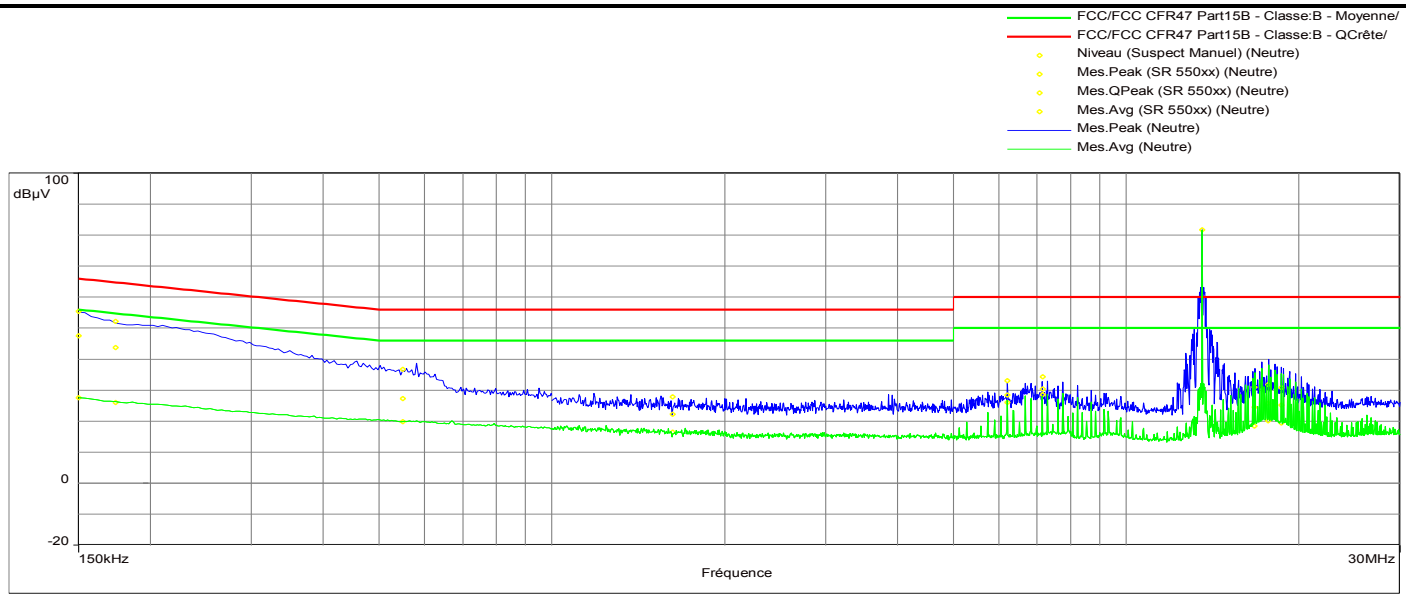


Spurious emissions

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line
13.560	Fundamental frequency							

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line
0.150	55.0	47.6	66.0	-18.4	27.6	56.0	-28.4	Phase 1
0.178	51.5	43.2	64.6	-21.3	26.0	54.6	-28.6	Phase 1
0.614	37.9	28.2	56.0	-27.8	19.7	46.0	-26.3	Phase 1
1.392	28.4	22.6	56.0	-33.4	16.9	46.0	-29.1	Phase 1
16.448	35.8	26.5	60.0	-33.5	16.7	50.0	-33.3	Phase 1
16.908	37.0	30.3	60.0	-29.7	24.7	50.0	-25.3	Phase 1
17.528	35.8	33.2	60.0	-26.8	31.5	50.0	-18.5	Phase 1

CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Neutral J5-210	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 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)	Line
13.560	Fundamental frequency							

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line
0.150	55.4	47.6	66.0	-18.4	27.5	56.0	-28.5	Neutre
0.174	52.2	43.7	64.8	-21.1	26.0	54.8	-28.7	Neutre
0.550	36.6	27.2	56.0	-28.8	19.9	46.0	-26.1	Neutre
1.624	27.8	22.2	56.0	-33.8	16.4	46.0	-29.6	Neutre
6.216	33.0	28.4	60.0	-31.6	26.0	50.0	-24.0	Neutre
7.152	34.2	30.4	60.0	-29.6	28.6	50.0	-21.4	Neutre
16.744	31.0	24.5	60.0	-35.5	18.5	50.0	-31.5	Neutre
17.680	31.7	25.8	60.0	-34.2	20.0	50.0	-30.0	Neutre
18.632	30.8	25.2	60.0	-34.8	19.4	50.0	-30.6	Neutre

3.7. CONCLUSION

The sample of the equipment **JI6-200**, Sn: None, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part 15 Subpart C, for conducted emissions.

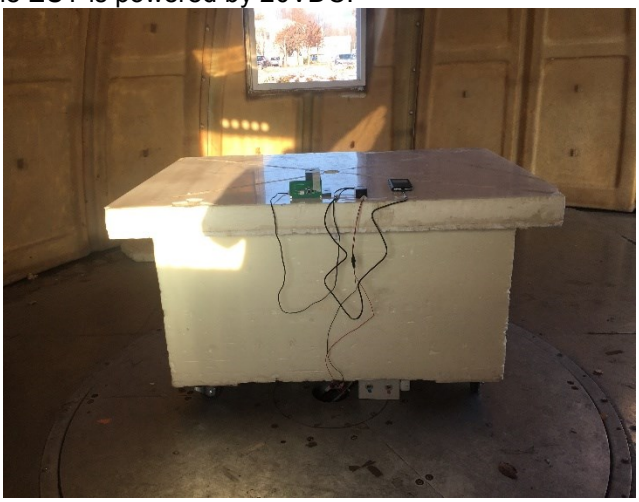
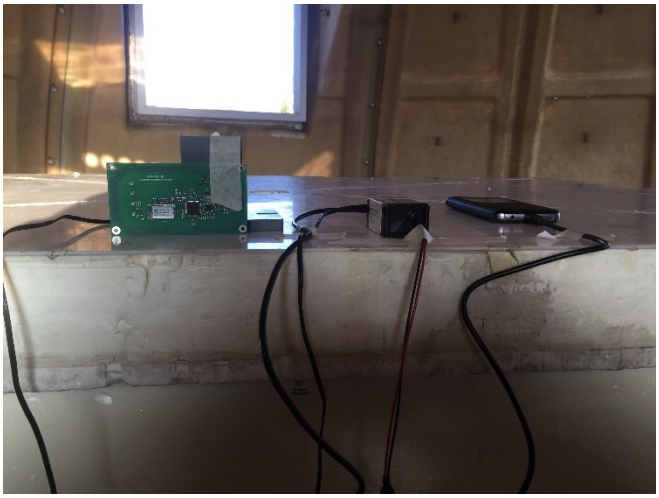
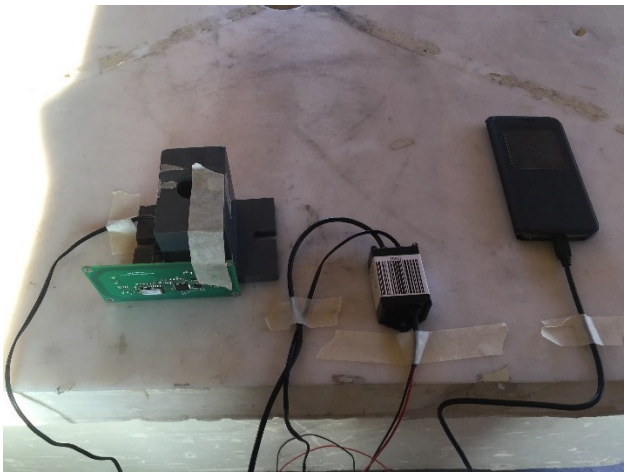
4. RADIATED EMISSION DATA (15.209)

4.1. ENVIRONMENTAL CONDITIONS

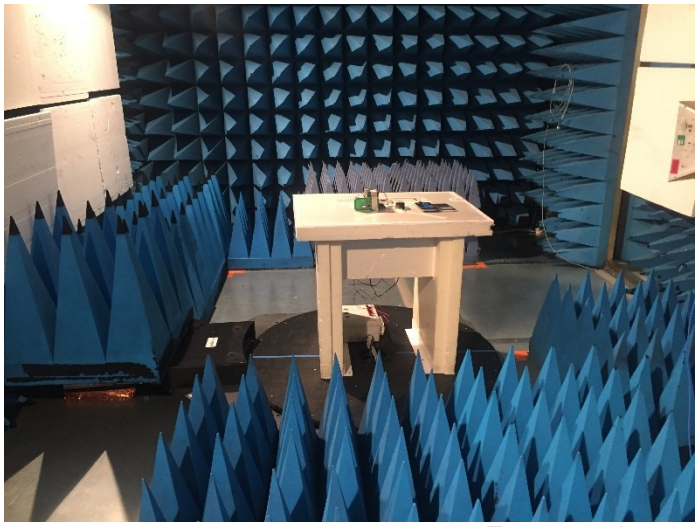
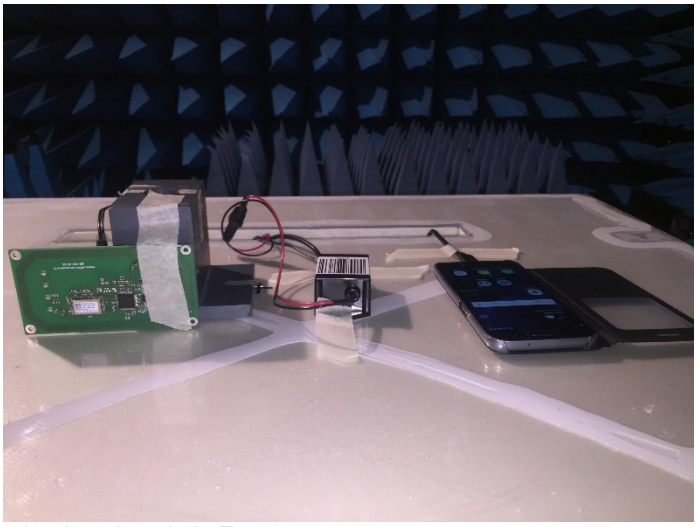
Date of test	:	December 4, 2017
Test performed by	:	Majid Mourzagh
Atmospheric pressure (hPa)	:	1010
Relative humidity (%)	:	26
Ambient temperature (°C)	:	21

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 20VDC.


Test setup on OATS Axis Z

Test setup in anechoic chamber Axis Z


Test setup in anechoic chamber Axis XY

4.3. TEST METHOD

The product has been tested according to ANSI C63.10, FCC Part 15 Subpart C.
Pre-characterisation measurement: (9kHz – 1GHz)
A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz 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. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration.

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.

4.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Amplifier 9kHz - 40GHz	LCIE SUD EST	_	A7102082	07/17	07/18
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 Measure @3m	-	-	A5329206	06/17	06/18
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	03/16	03/19
Radiated emission comb generator	BARDET	-	A3169050	-	-
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	08/17	08/18
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/16	10/18
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
Table	LCIE	-	F2000461	-	-

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
Cable	SUCOFLEX	106G	A5329061	04/17	04/18
Cable (OATS)	-	-	A5329623	03/17	03/18
Radiated emission comb generator	BARDET	-	A3169050	-	-
OATS	-	-	F2000409	10/17	10/18
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	08/17	08/18
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
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	-	F2000445	-	-

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

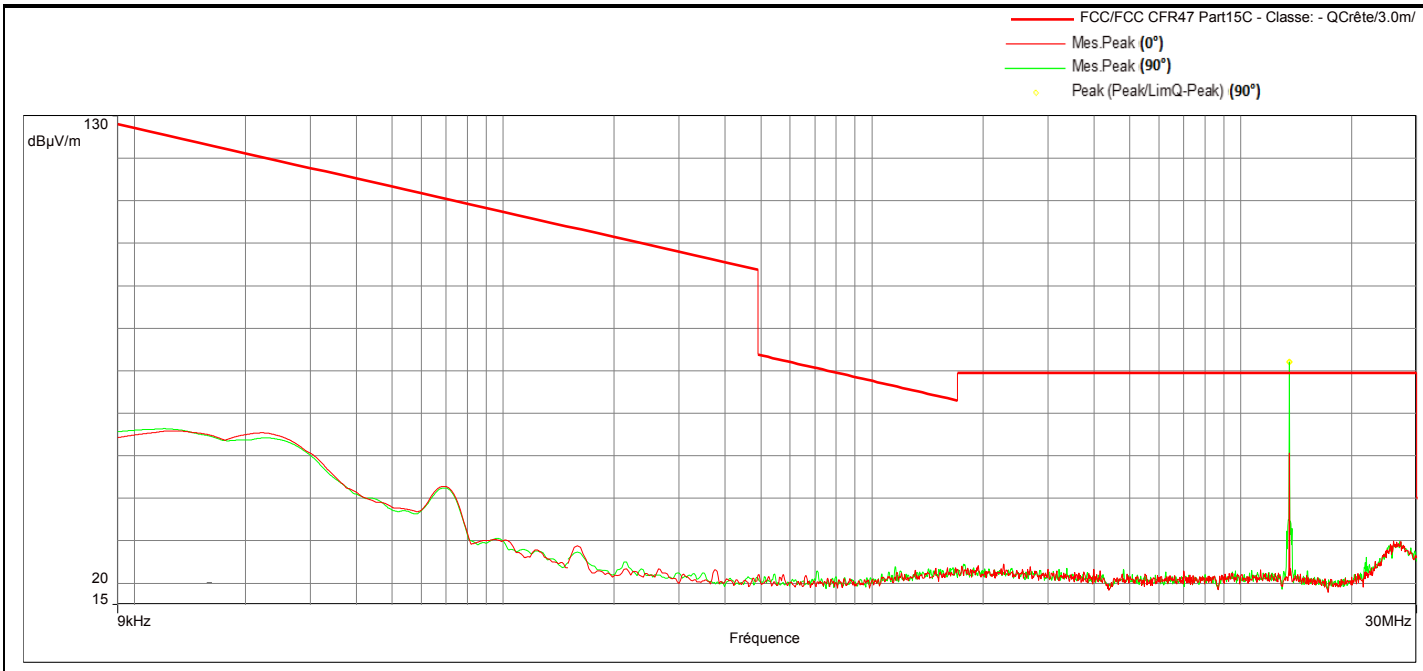
4.6. TEST RESULTS

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 Z	Worst case	See below
Emr#	2	0°/90°	Axis XY	-	See below

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

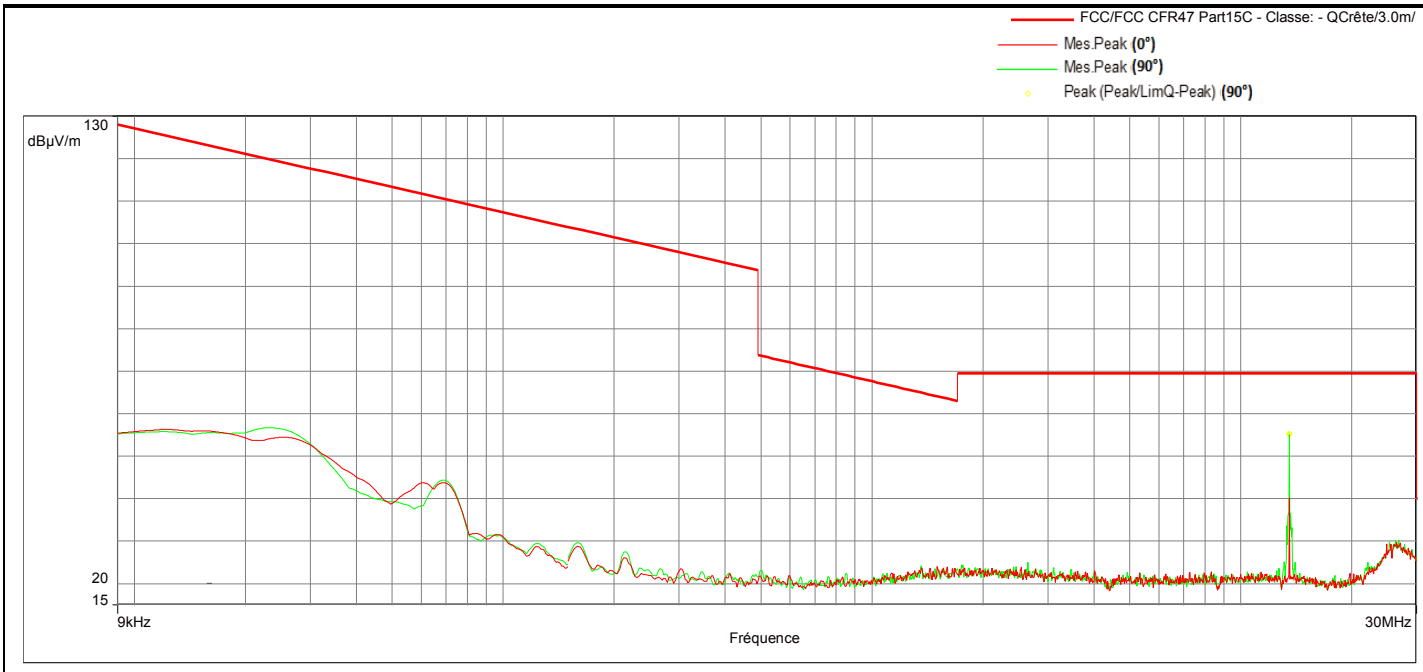


Spurious emissions

No significative frequency observed

Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Polarization	Correction (dB)
13.562	72.1	69.5	2.6	Vertical	-0.2

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



Spurious emissions

No significative frequency observed

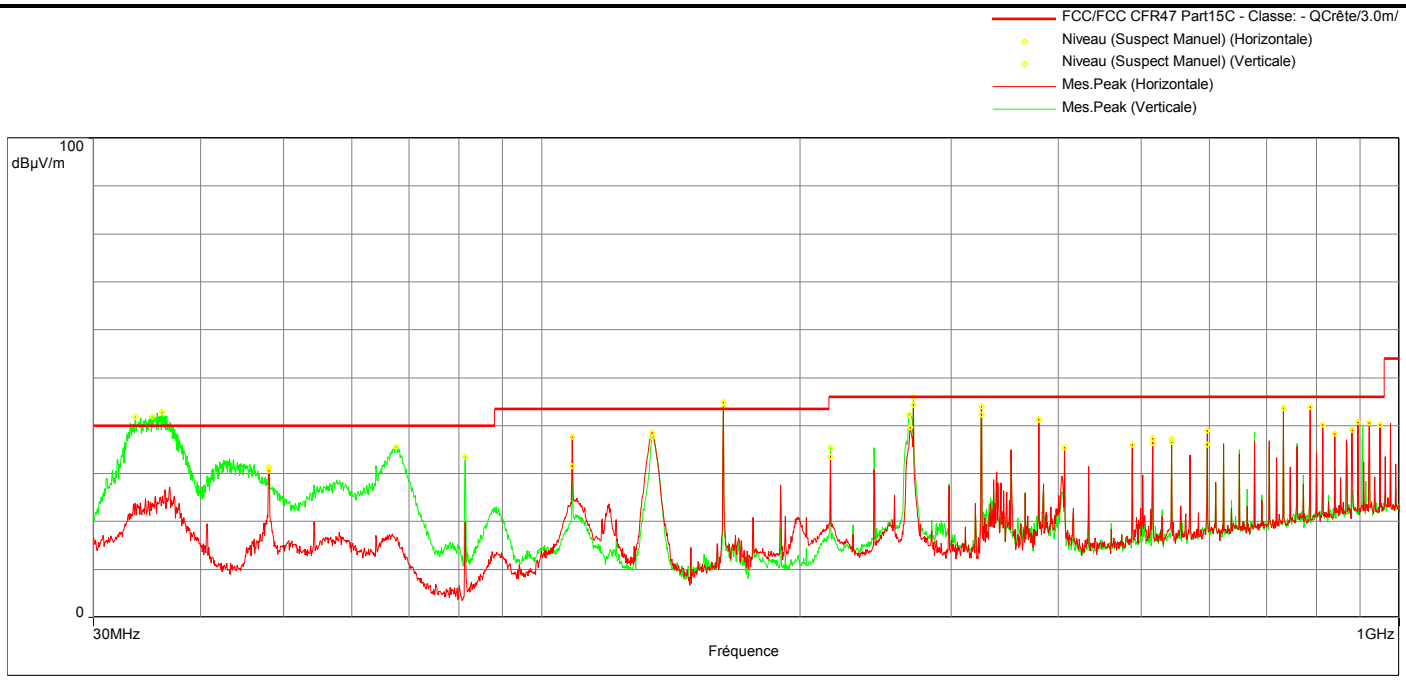
Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Polarization	Correction (dB)
13.562	55.1	69.5	-14.4	Vertical	-0.2

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 Z	Worst case	See below
Emr# 4	Vertical/ Horizontal	Axis XY	-	See below

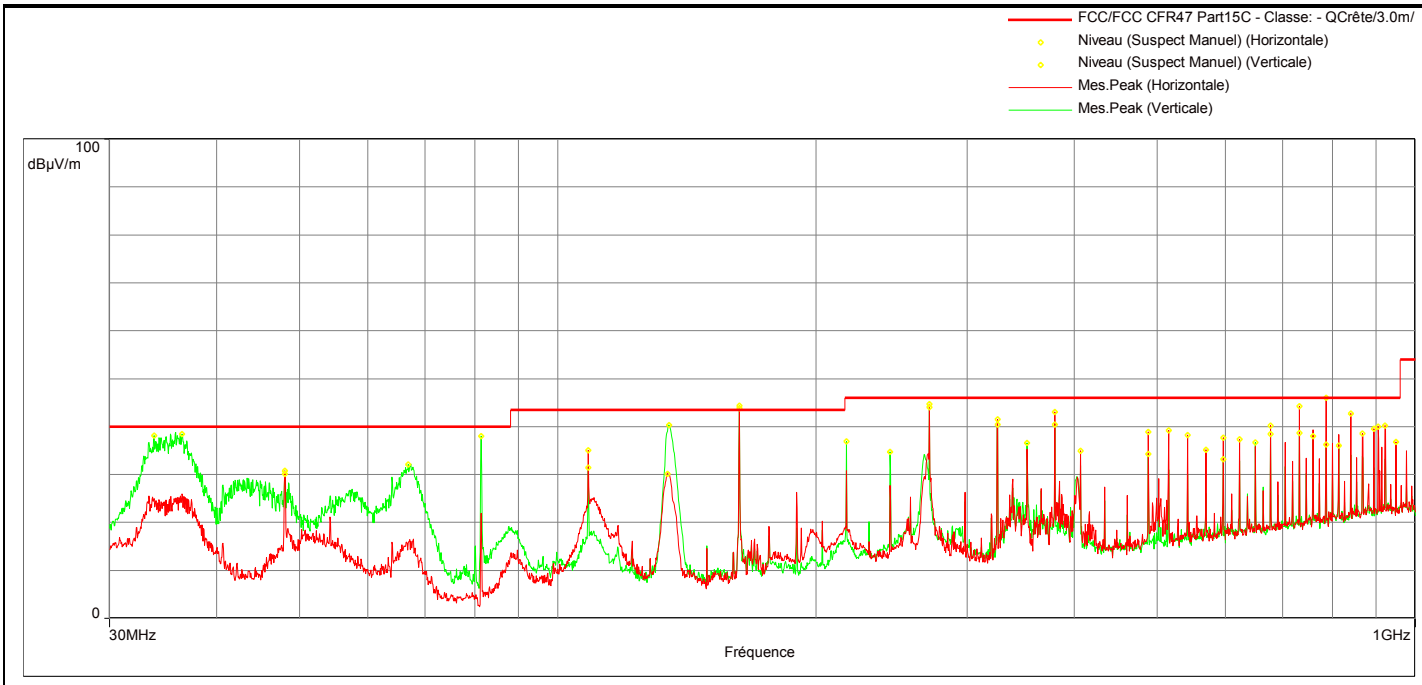
RADIATED EMISSIONS			
Graph name:	Emr#3	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Axis Z<1GHz	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization
48.054	30.6	Horizontal
108.489	37.7	Horizontal
134.465	38.5	Horizontal
162.753	45.0	Horizontal
216.960	33.5	Horizontal
268.880	39.6	Horizontal
271.240	44.4	Horizontal
325.480	44.0	Horizontal
379.720	41.3	Horizontal
406.840	35.5	Horizontal
488.240	36.0	Horizontal
515.360	37.4	Horizontal
542.480	36.6	Horizontal
596.760	39.0	Horizontal
732.320	43.7	Horizontal
786.600	43.9	Horizontal
813.720	40.2	Horizontal
840.840	38.4	Horizontal
880.480	39.2	Horizontal
895.080	40.7	Horizontal
922.200	40.7	Horizontal
949.360	40.2	Horizontal
33.570	41.8	Vertical
35.134	41.9	Vertical
36.052	42.8	Vertical
48.037	31.3	Vertical
67.604	35.6	Vertical
81.374	33.5	Vertical
108.489	31.5	Vertical
134.550	37.6	Vertical
162.753	43.9	Vertical
216.960	35.3	Vertical
268.040	42.2	Vertical
271.240	45.9	Vertical
325.480	42.3	Vertical
379.720	41.2	Vertical
515.360	36.4	Vertical
542.480	37.3	Vertical
596.720	36.0	Vertical

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



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization
48.054	30.8	Horizontal
108.489	35.0	Horizontal
134.227	30.2	Horizontal
162.753	43.8	Horizontal
271.200	44.7	Horizontal
325.480	41.5	Horizontal
379.720	43.1	Horizontal
406.840	34.9	Horizontal
488.240	38.9	Horizontal
515.360	39.2	Horizontal
542.480	38.2	Horizontal
569.600	35.1	Horizontal
596.720	37.7	Horizontal
623.840	37.4	Horizontal
678.080	40.2	Horizontal
732.320	44.3	Horizontal
786.600	46.0	Horizontal

Frequency (MHz)	Peak Level (dBµV/m)	Polarization
840.840	42.7	Horizontal
867.960	38.5	Horizontal
895.080	39.5	Horizontal
905.040	39.9	Horizontal
922.200	40.2	Horizontal
949.320	36.8	Horizontal
33.808	38.1	Vertical
36.460	38.4	Vertical
48.071	30.2	Vertical
66.873	32.1	Vertical
81.374	38.0	Vertical
108.489	31.4	Vertical
134.703	40.3	Vertical
162.753	44.4	Vertical
216.960	36.9	Vertical
244.080	34.7	Vertical
271.240	44.0	Vertical
325.480	40.4	Vertical
352.600	36.6	Vertical
379.720	40.4	Vertical
488.240	34.3	Vertical
596.720	33.2	Vertical
650.960	36.6	Vertical
678.080	38.4	Vertical
732.320	38.7	Vertical
759.440	38.0	Vertical
786.600	36.2	Vertical
813.720	36.0	Vertical

4.6.3. 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.

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
13.56	84	38.9	**-45.1**	0	90°	110	35.3	Axis Z

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.

4.6.4. 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)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
33.500	13.5	QP	V	0	100	18.3	31.8	40.0	-8.2
35.134	13.7	QP	V	0	110	17.4	31.1	40.0	-8.9
36.050	13.2	QP	V	45	110	16.9	30.1	40.0	-9.9
48.000	20.1	QP	V	0	100	10.4	30.5	40.0	-9.5
67.600	17.7	QP	V	180	110	7.8	25.5	40.0	-14.5
81.300	13.0	QP	V	270	110	9.0	22.0	40.0	-18.0
108.750	16.9	QP	H	0	250	12.6	29.5	43.5	-14.0
134.550	27.1	QP	V	180	120	13.9	41.0	43.5	-2.5
162.742	25.9	QP	V	250	100	12.4	38.3	43.5	-5.2
216.980	28.5	QP	V	340	100	13.0	41.5	46.0	-4.5
268.040	18.9	QP	V	90	100	16.0	34.9	46.0	-11.1
271.240	21.8	QP	V	320	110	16.0	37.8	46.0	-8.2
325.480	23.3	QP	V	40	100	17.5	40.8	46.0	-5.2
379.700	20.5	QP	H	240	300	19.3	39.8	46.0	-6.2
406.840	10.9	QP	H	180	280	20.1	31.0	46.0	-15.0
488.250	11.5	QP	V	250	100	22.1	33.6	46.0	-12.4
515.350	14.8	QP	H	180	280	22.7	37.5	46.0	-8.5
542.480	9.1	QP	V	180	120	23.3	32.4	46.0	-13.6
732.300	12.3	QP	V	141	120	26.8	39.1	46.0	-6.9
786.600	8.1	QP	V	180	125	27.8	35.9	46.0	-10.1
813.700	16.1	QP	H	180	270	28.2	44.3	46.0	-1.7
840.840	15.5	QP	V	0	310	28.6	44.1	46.0	-1.9
880.480	8.9	QP	H	326	240	29.2	38.1	46.0	-7.9
922.200	10.4	QP	H	180	240	30.0	40.4	46.0	-5.6
949.360	12.2	QP	V	180	130	30.6	42.8	46.0	-3.2

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

4.7. CONCLUSION

The sample of the equipment JI6-200, Sn: None, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part 15 Subpart C, for radiated emissions.

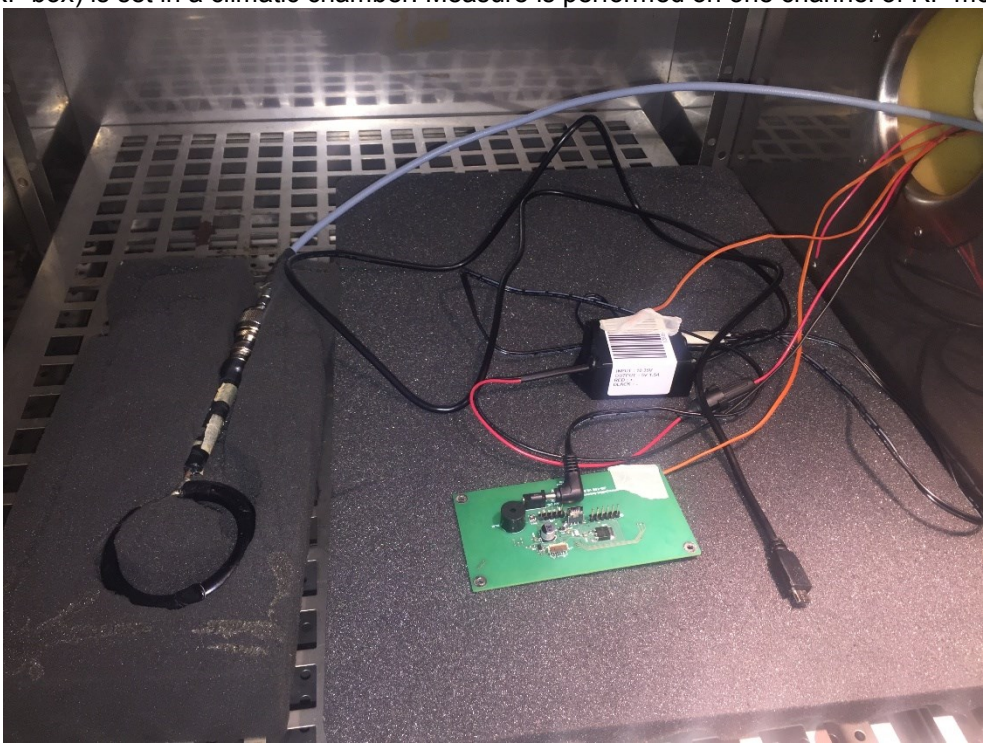
5. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)

5.1. ENVIRONMENTAL CONDITIONS

Date of test	:	December 5, 2017	December 6, 2017
Test performed by	:	Majid Mourzagh	Majid Mourzagh
Atmospheric pressure (hPa)	:	1013	1001
Relative humidity (%)	:	24	39
Ambient temperature (°C)	:	22	23

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.



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 -30°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
Cable SMA	-	18G	A5329373	12/16	12/17
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	05/17	05/19
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18
Receiver 10Hz – 7GHz	ROHDE & SCHWARZ	ESR	A2642026	02/17	02/18
Thermometer (radio)	FLUKE	52 II	B4043150	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045005	04/17	04/18
Antenna Loop	LCIE	-	-	-	-

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

5.6. TEST RESULTS

Temperature / Voltage	-30°C	-20°C	20°C	+50°C
Mains voltage: 24VDC Frequency Drift (MHz) Carrier level (dBc)	 - 0.000064 - 0.11	 - 0.000064 + 0.02	 **13.56** **39.650000**	 - 0.000064 - 1.49
Mains voltage: 20.4VDC Frequency Drift (MHz) Carrier level (dBc)	 - 0.000064 - 0.13	 - 0.000064 - 0.08	 + 0.000000 - 0.02	 - 0.000064 - 1.51
Mains voltage: 27.5VDC Frequency Drift (MHz) Carrier level (dBc)	 - 0.000064 - 0.12	 - 0.000064 - 0.10	 + 0.000032 - 0.04	 - 0.000064 - 1.50

Frequency drift measured is 3384Hz and - 64Hz when the temperature is varied from -30°C to +50°C and voltage is varied.

5.7. CONCLUSION

The sample of the equipment JI6-200, Sn: None, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C, for fundamental frequency tolerance.

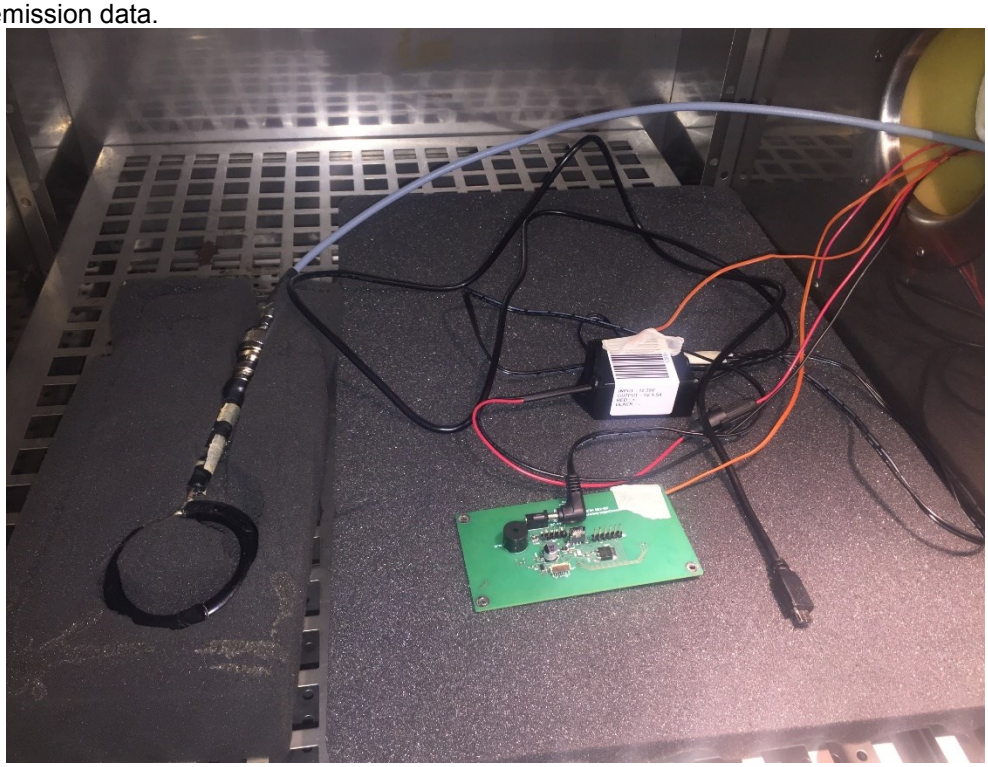
6. BAND-EDGE COMPLIANCE §15.209

6.1. ENVIRONMENTAL CONDITIONS

Date of test	:	December 5, 2017
Test performed by	:	Majid Mourzagh
Atmospheric pressure (hPa)	:	1013
Relative humidity (%)	:	24
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

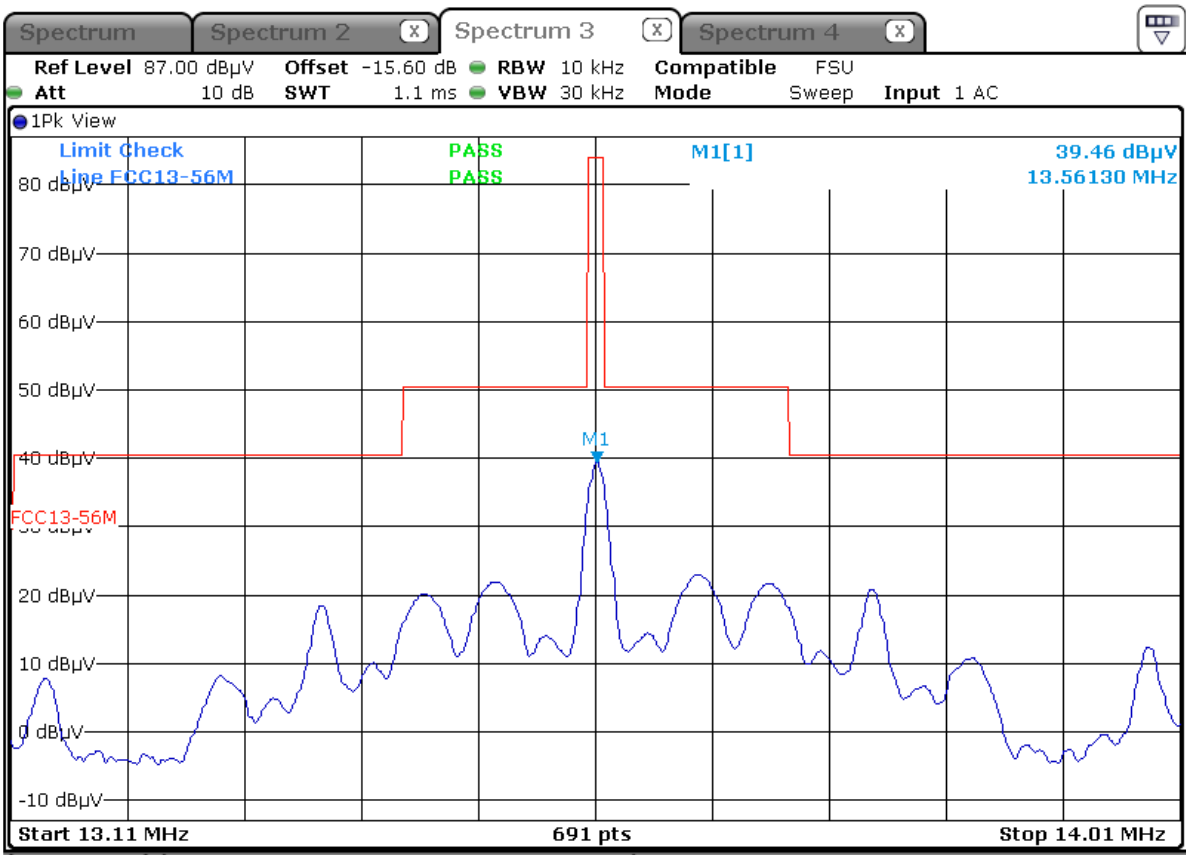
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable SMA	-	18G	A5329373	12/16	12/17
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	05/17	05/19
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18
Receiver 10Hz – 7GHz	ROHDE & SCHWARZ	ESR	A2642026	02/17	02/18
Thermometer (radio)	FLUKE	52 II	B4043150	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045005	04/17	04/18
Antenna Loop	LCIE	-	-	-	-

6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

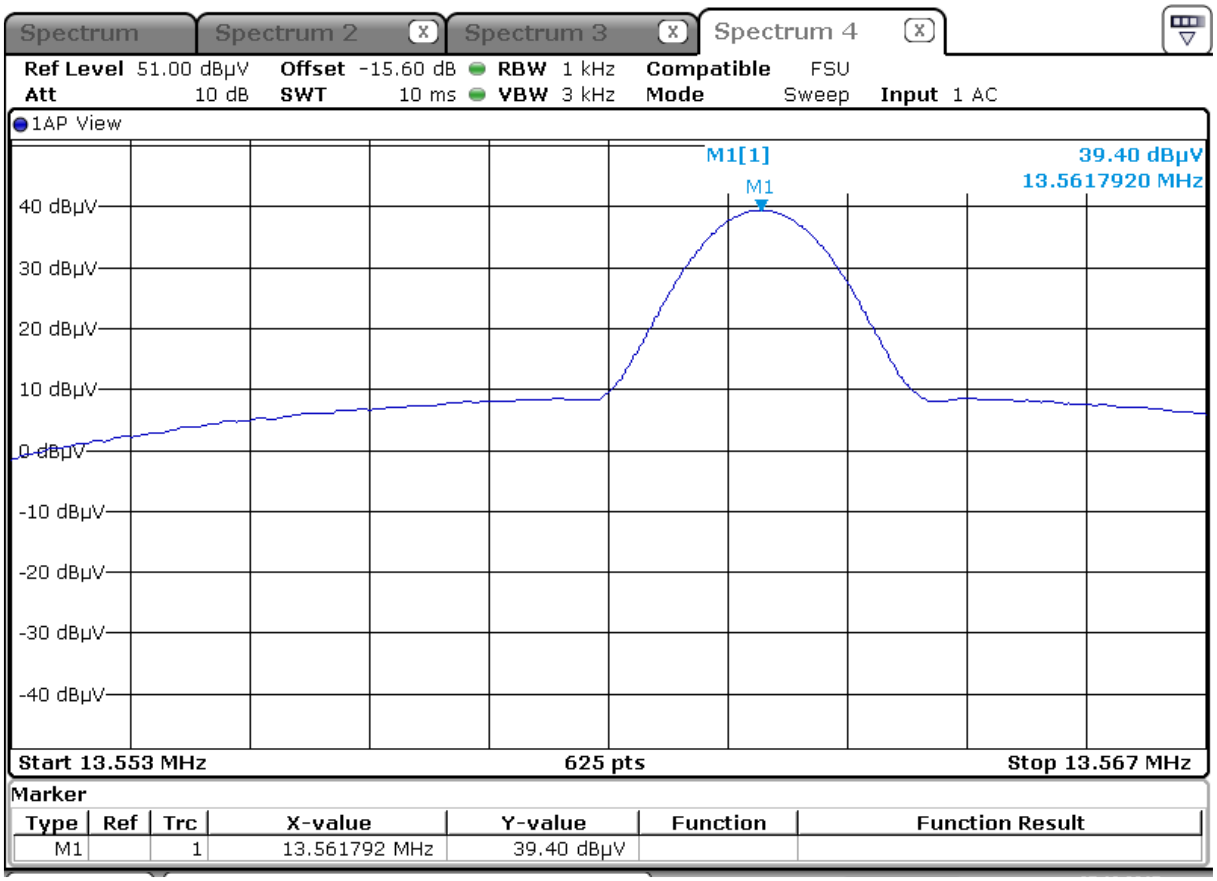
☑ None ☐ Divergence:

6.6. TEST RESULTS

Frequency band 13.110-14.010MHz



Frequency band 13.553-13.567MHz



6.7. CONCLUSION

The sample of the equipment JI6-200, Sn: None, 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 : December 5, 2017
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 1013
Relative humidity (%) : 24
Ambient temperature (°C) : 22

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.
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 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

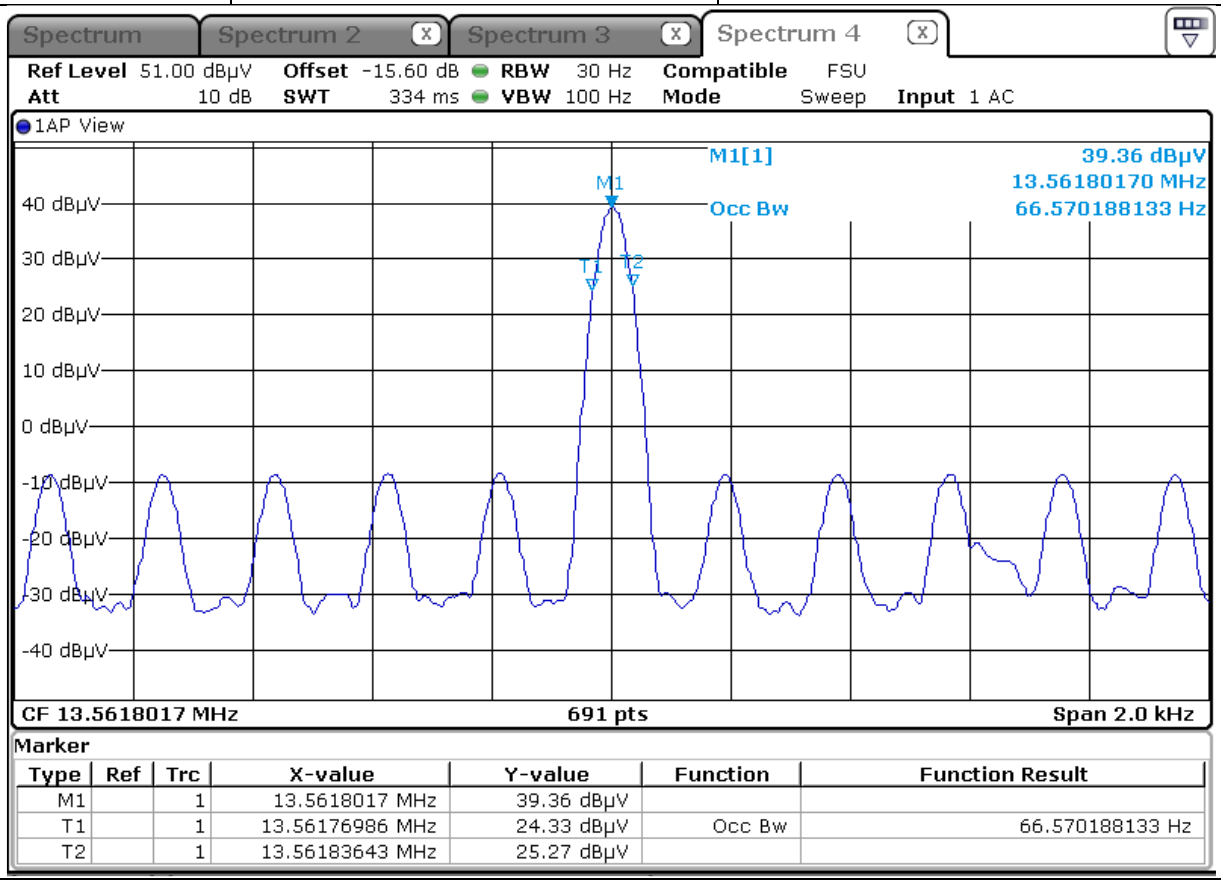
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable SMA	-	18G	A5329373	12/16	12/17
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	05/17	05/19
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18
Receiver 10Hz – 7GHz	ROHDE & SCHWARZ	ESR	A2642026	02/17	02/18
Thermometer (radio)	FLUKE	52 II	B4043150	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045005	04/17	04/18
Antenna Loop	LCIE	-	-	-	-

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 (Hz)
Nom	13.56	**66.570**



8. 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.*