Release July, 2017

TEST REPORT

N°: 154823-719429-A (File#994208) **Version : 01**

Subject	**Electromagnetic compatibility tests according to the standards:** **FCC CFR 47 Part 15, Subpart C** **RSS-210 Issue 9**
Issued to	**MARKEM IMAJE INDUSTRIES** 9 rue Gaspard Monge 26500 – BOURG LES VALENCE FRANCE
Apparatus under test	
↳ Product	Ink Jet Printer
↳ Trade mark	**MARKEM IMAJE**
↳ Manufacturer	**MARKEM IMAJE INDUSTRIES**
↳ Type / Model	**9018 ; 9028 & 9029**
↳ Model under test	**9029**
↳ Serial number	**FR18130154**
↳ FCCID	**2AAW8-MI9000**
↳ IC	**11372A-MI9000**
Conclusion	See Test Program chapter
Test date	April 17, 2018 to April 19, 2018
Test location	MOIRANS
IC Test site	6500A-1 & 6500A-3
Composition of document	27 pages
Document issued on	April 20, 2018

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	April 20, 2018	Majid MOURZAGH	Creation of the document

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 :*** ***(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. JUSTIFICATION

The system was configured for testing in a typical fashion (as a customer would normally use it).
Printer 9018 , 9028 & 9029 are same electronic, differences are:

1. Index of protection IP44 (9018), IP54 (9028 & 9029)
2. Pressurization of the print head by external compressed air to the printer, air-network customer (9018); by autonomous compressor provided inside the printer(9028 & 9029)
3. Possibility of impression of 3 lines maximum (9018), 4 lines (9028 & 9029).
4. Printer 9029 is the same as the 9028 except for aesthetic variations not safety related

RFID is activated by software following option choice by user.

All tests are performed on 9029 with RFID ON, worst case.

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
9029
FCC ID: 2AAW8-MI9000

IC: 11372A-MI9000

Serial Number: FR18130154

Photography of EUT

Power supply:
During all the tests, EUT is supplied by V_{nom}:110VAC/60Hz
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Main supply	☑ AC ☐ DC ☐ Battery	100-240VAC, 50-60Hz	/	/

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Main supply	P+N+E	2	☑	☐	☑	
Umbilical cable	Printing head cable	3	☑	☑	☑	
Beacon cable	Status beacon input	5	☐	☐	☑	
Tachymeter cable	Tachymeter input	6	☐	☐	☑	
Proximity Cell cable	Proximity cell input	6	☐	☐	☑	

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Proximity cell	A45638	D451	/
Pulse encoder	A41370	B11219C194 -4	/
Beacon	FB194	16419P	Model MP-_02C
Relay output option	A54006	/	Reference Markem Imaje

Equipment information:

Frequency band:	☑ [13.553–13.567]MHz	☐ [125]kHz	☐ [-] MHz	
Sub-band REC7003:	☑ Annex 9 (j)	☐ Annex 9 (a3)	☐ Annex ( )	
RF mode:	☐ Transmitter	☑ Transceiver	☐ Receiver	☐ Standby
Type:	☑ RFID	☐ EAS	☐ Other:	
Bandwidth:	☐ Narrowband (ISO15693, ISO18000-3…)		☑ Wideband (ISO14443, NFC…)	
Product class – Annex B.2	☑ 1	☐ 2	☐ 3	☐ 4
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	☑ +5 °C
	Tnom:	20°C		
	Tmax:	☐ 35°C	☐ 55°C	☑ +45 °C
Type of power source:	☑ AC power supply	☐ DC power supply	☐ Battery (Select type)	
Test source voltage:	Vmin:	☑ 93.5V/60Hz	☐ VDC	
	Vnom:	☑ 110V/50Hz	☐ VDC	
	Vmax	☑ 126V/50Hz	☐ VDC	

2.3. EUT CONFIGURATION

Continuous printing message 24 points and reading in loop of 3 TAGs ink, additive cartridge and MI box.

Firmware-version

Boot: 1.0 1183
CPU: 9029L_1.0 2034
FPGA: 1.1.3
RFID: 0.29

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	:	April 18, 2018
Test performed by	:	Majid Mourzagh
Atmospheric pressure (hPa)	:	1004
Relative humidity (%)	:	32
Ambient temperature (°C)	:	22

3.2. TEST SETUP

Mains terminals

The EUT and auxiliaries are set:

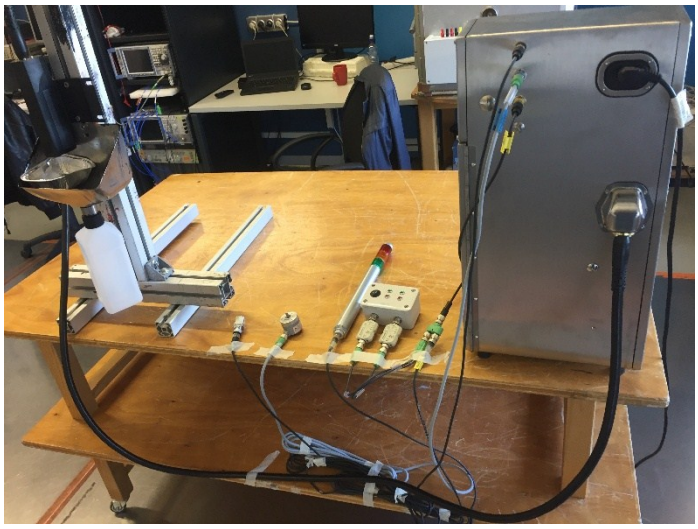
☑ 80cm above the ground on the non-conducting table (Table-top equipment)

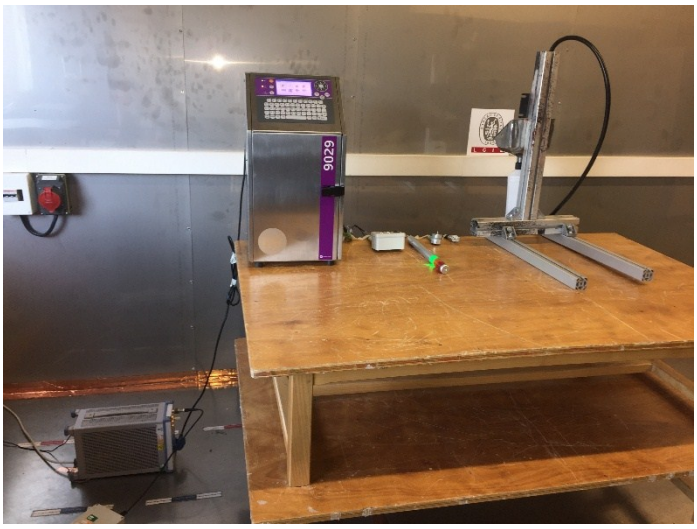
☐ 10cm above the ground on isolating support (Floor standing equipment)

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.






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	-	-	A5329585	07/17	07/18
EMC comb generator	LCIE SUD EST	-	A3169098	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320291	12/17	12/18
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	12/18
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204	02/18	02/19

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

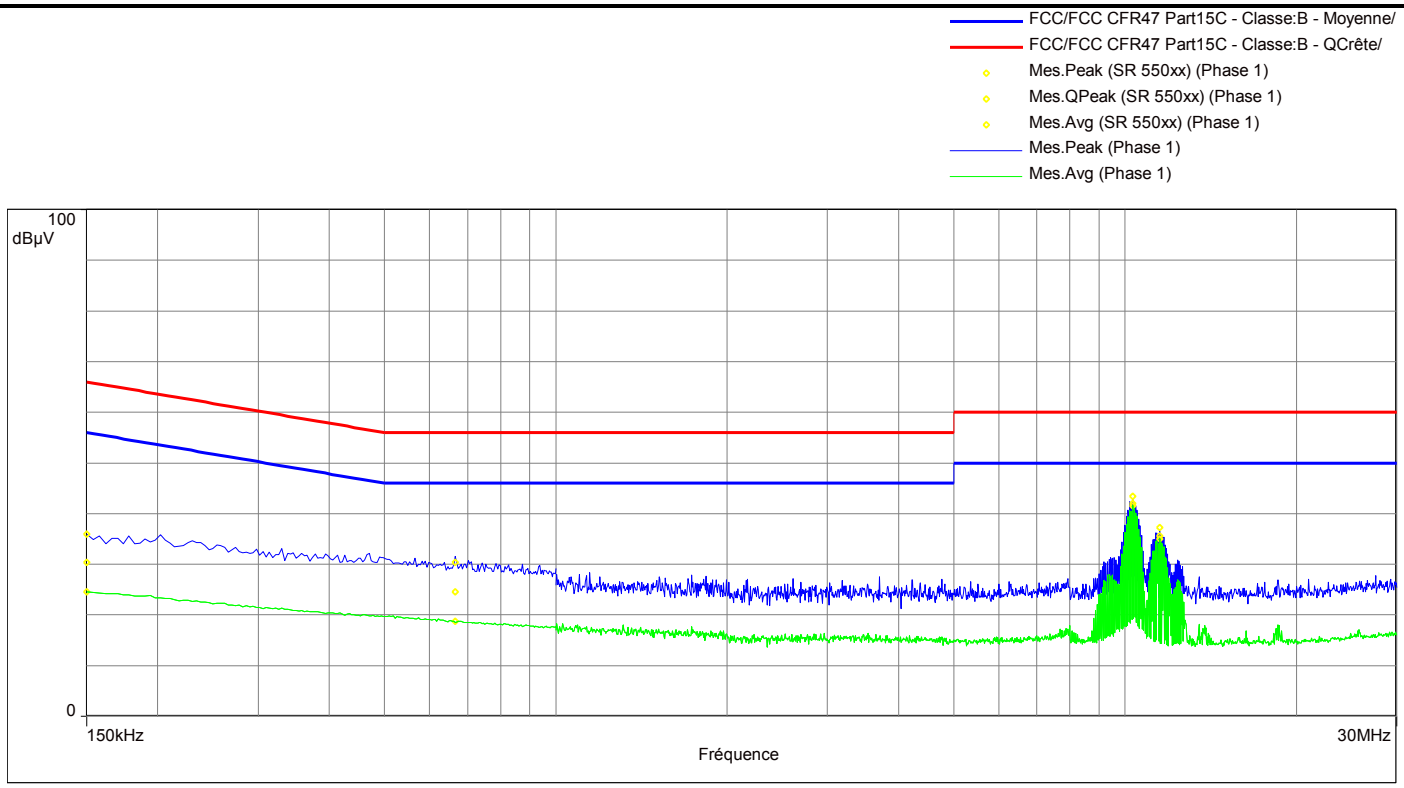
3.6. TEST RESULTS

Mains terminals:

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

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

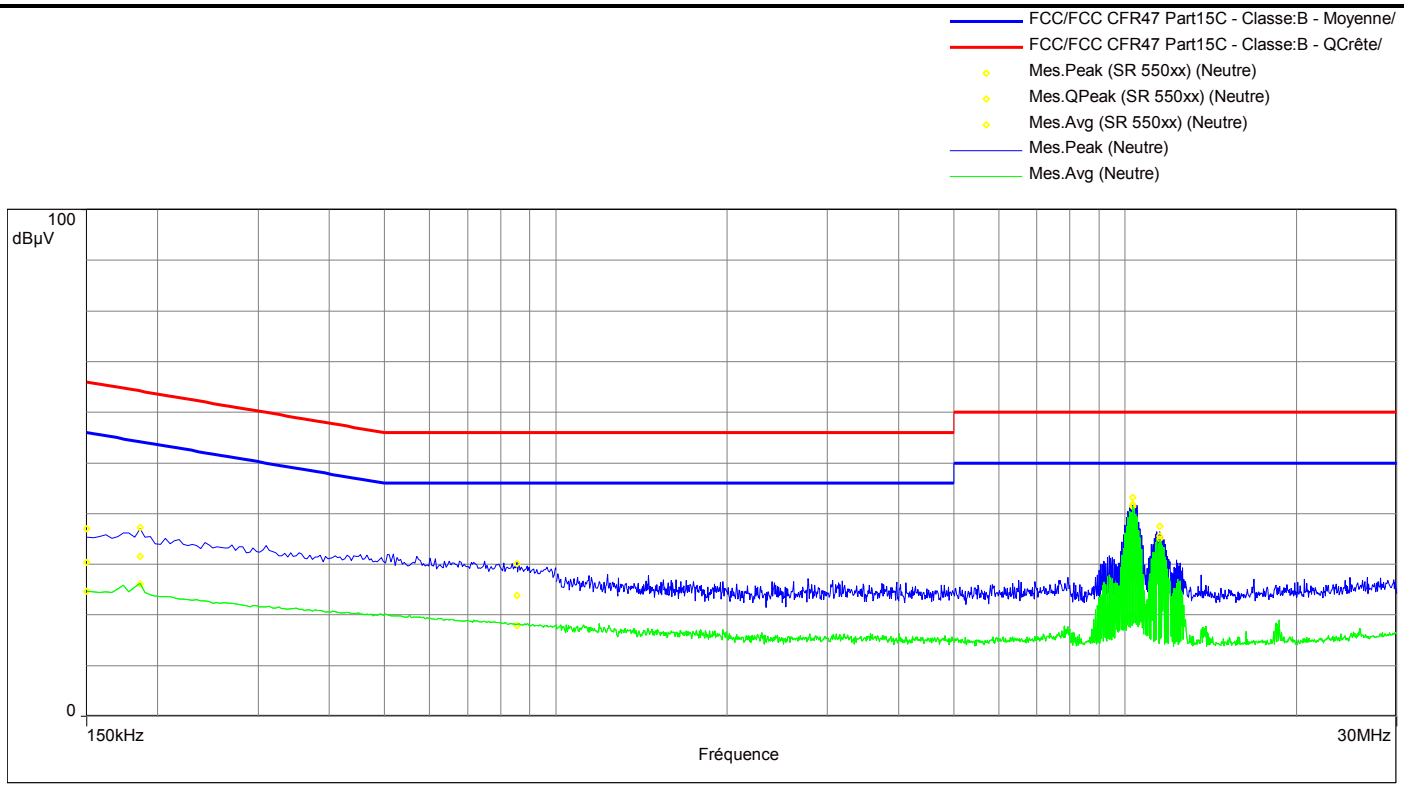
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	Line: 110VAC/60Hz Printer 9029	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



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	Correction (dB)
0.150	36.0	30.4	66.0	-35.6	24.5	56.0	-31.5	Phase 1	19.4
0.666	30.4	24.5	56.0	-31.5	18.8	46.0	-27.2	Phase 1	19.5
10.312	43.4	42.0	60.0	-18.0	41.6	50.0	-8.4	Phase 1	20.2
11.500	37.2	35.6	60.0	-24.4	35.0	50.0	-15.0	Phase 1	20.2

CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	Neutral: 110VAC/60Hz Printer 9029	
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	Correction (dB)
0.150	37.1	30.4	66.0	-35.6	24.6	56.0	-31.4	Neutre	19.4
0.186	37.2	31.6	64.2	-32.6	26.1	54.2	-28.1	Neutre	19.5
0.854	30.1	23.8	56.0	-32.2	18.0	46.0	-28.0	Neutre	19.5
10.312	43.2	41.7	60.0	-18.3	41.4	50.0	-8.6	Neutre	20.2
11.500	37.5	35.6	60.0	-24.4	35.0	50.0	-15.0	Neutre	20.2

3.7. CONCLUSION

The sample of the equipment 9029, Sn: FR18130154, 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.

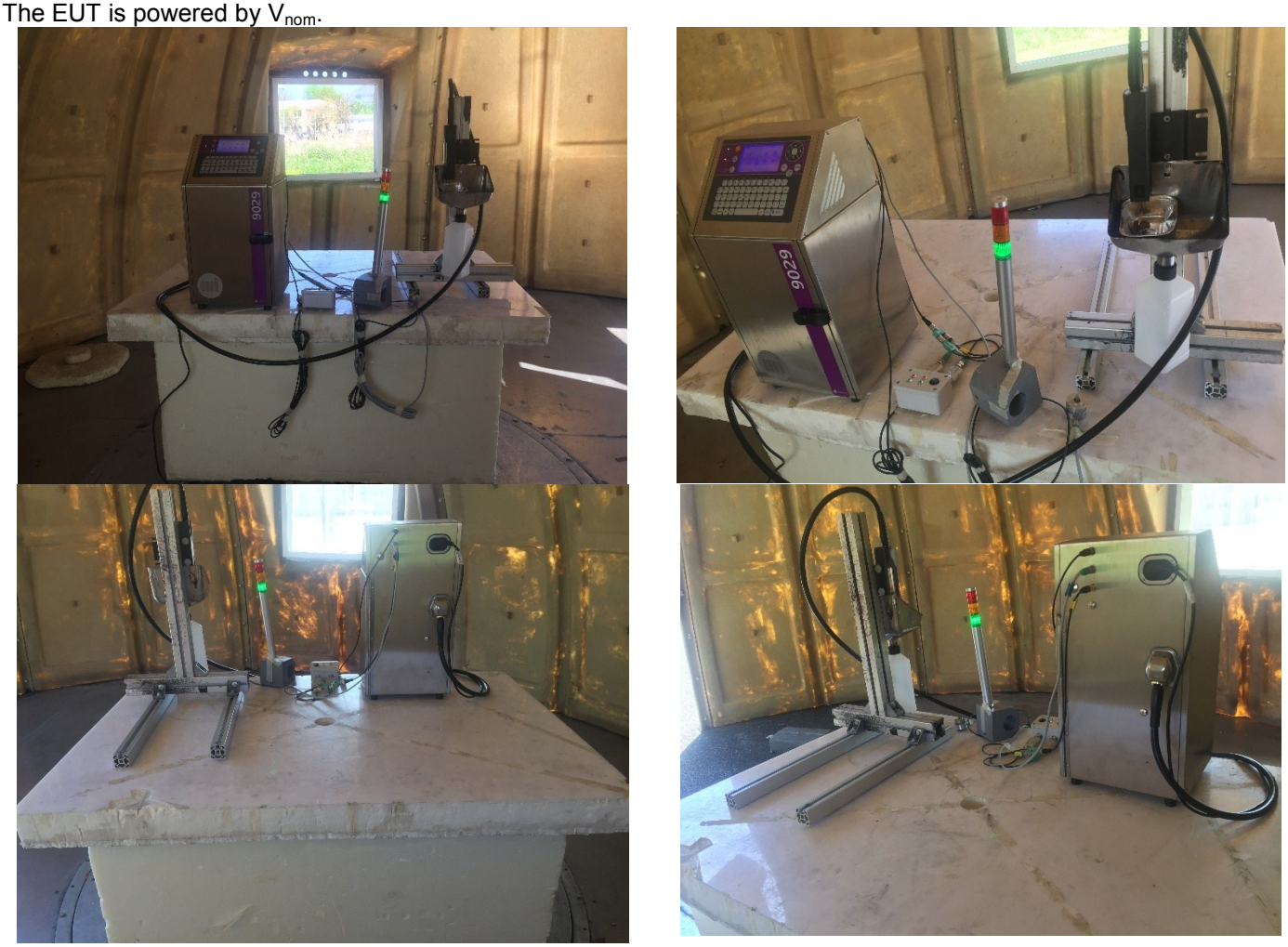
4. RADIATED EMISSION DATA (15.209)

4.1. ENVIRONMENTAL CONDITIONS

Date of test	:	April 17, 2018
Test performed by	:	Majid Mourzagh
Atmospheric pressure (hPa)	:	1000
Relative humidity (%)	:	30
Ambient temperature (°C)	:	20

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

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	11/17	11/19
Antenna Bi-log	CHASE	CBL6111A	C2040172	06/16	06/18
Cable Measure @3m 18GHz	-	18GHz	A5329038	12/17	12/18
Cable SMA	-	6GHz	A5329635	02/18	02/19
Cable Measure Analyzer-Amplifier SMA	STORMFLEX	26GHz	A5329681	12/17	12/18
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	03/16	03/19
Radiated emission comb generator	BARDET	-	A3169050	-	-
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	12/17	12/18
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
Table C3	LCIE	-	F2000461	-	-
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444	-	-
Antenna Bi-log	CHASE	CBL6111A	C2040051	01/18	01/19
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/17	11/19
Emission Cable	-	6GHz	A5329069	07/17	07/18
Cable (OATS)	-	1GHz	A5329623	03/18	03/19
Radiated emission comb generator	BARDET	-	A3169050	-	-
OATS	-	-	F2000409	10/17	10/18
Amplifier 9kHz - 50MHz	HEWLETT PACKARD	8447F	A7486006	04/17	04/18
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A4060049	11/17	11/19
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/16	08/18
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 C1/OATS	LCIE	-	F2000445	-	-

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

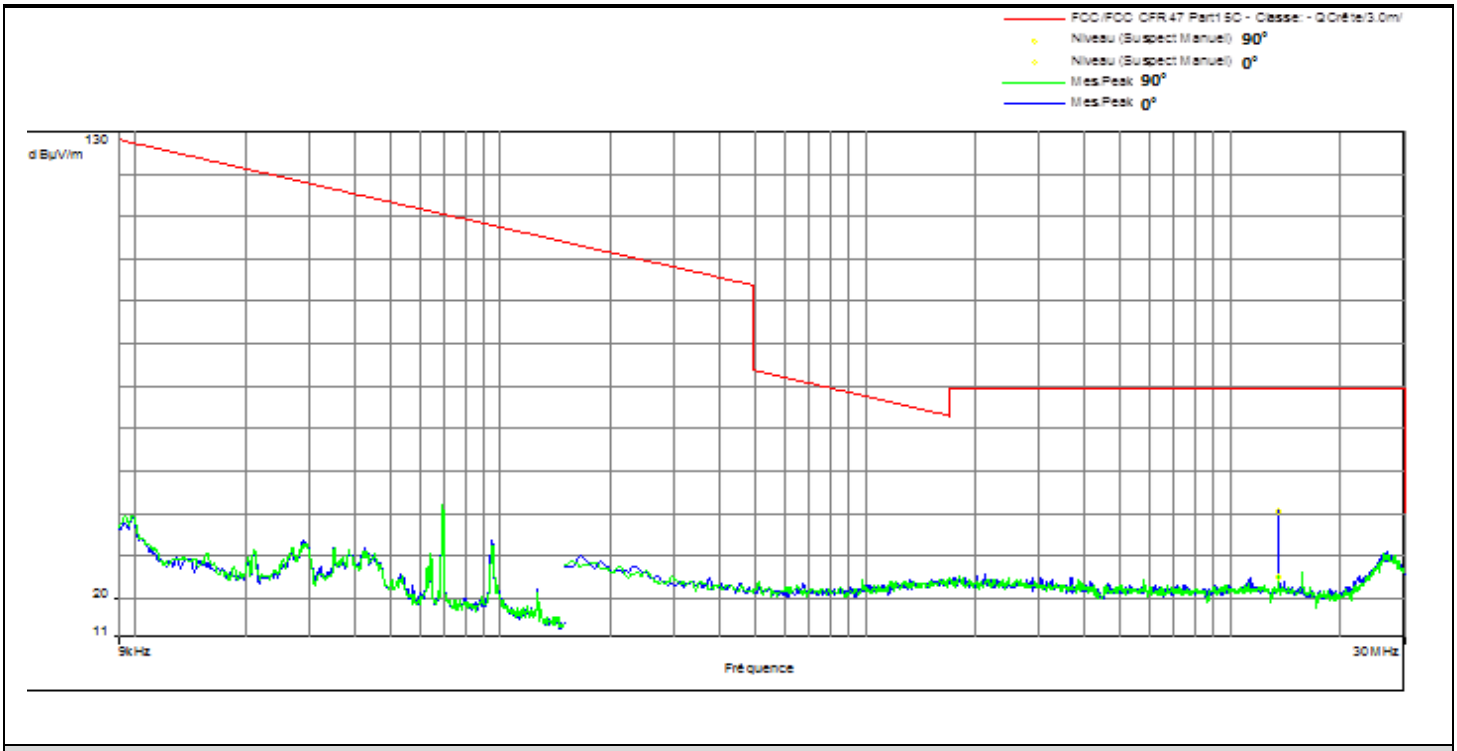
4.6. TEST RESULTS

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 XY		See annex 1

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(0°/90°) - 9029	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:	(0°/90°)	**RBW :**	300Hz / 10kHz
Azimuth:	0° - 360°	**VBW :**	1kHz / 30kHz



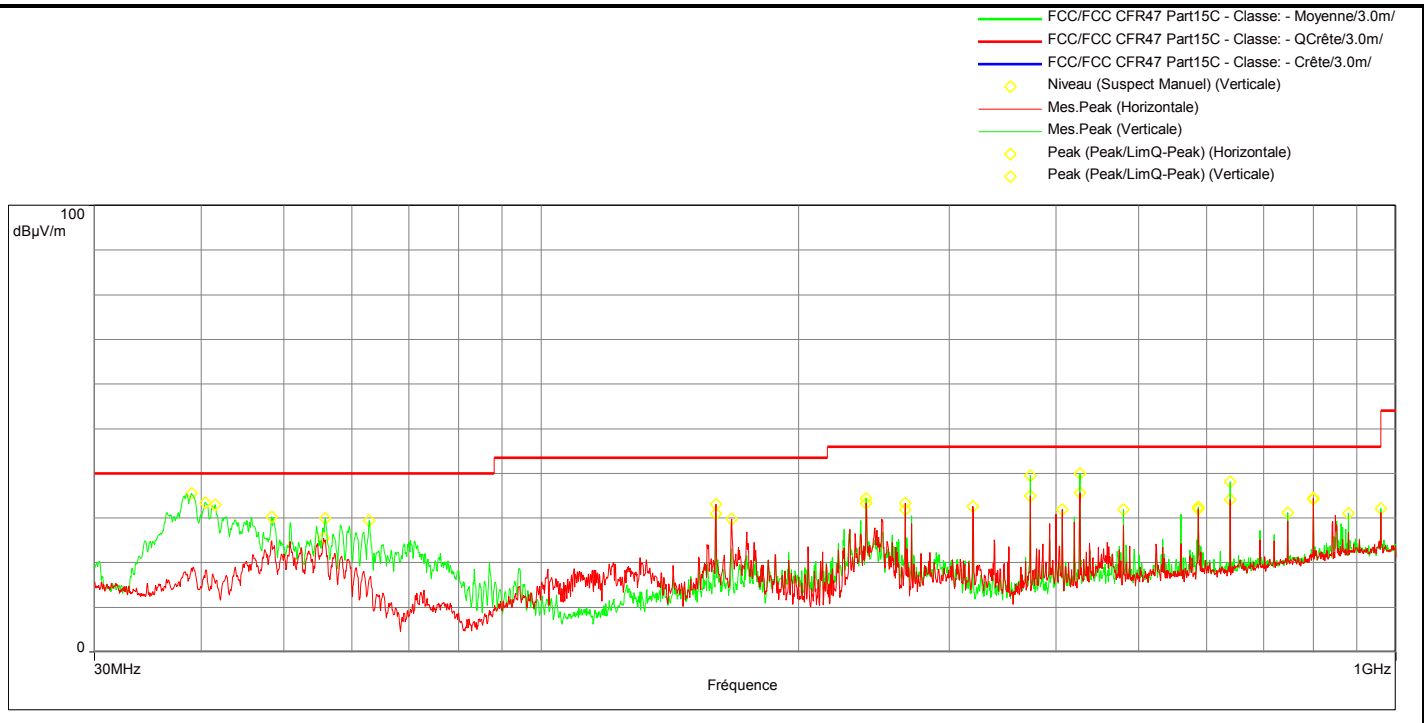
Spurious emissions		
Frequency (MHz)	**Peak Level (dBµV/m)**	**Polarization**
13.559	25.1	90°
13.559	40.5	0°

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

See graphs for 30MHz-1GHz:

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

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	Configuration 1 FFC part15C <1GHz	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Polarization	Correction (dB)
55.636	25.4	40.0	-14.6	Horizontal	-26.9
160.016	33.1	43.5	-10.4	Horizontal	-22.4
166.969	29.8	43.5	-13.7	Horizontal	-23.1
240.000	33.4	46.0	-12.6	Horizontal	-21.1
266.640	33.3	46.0	-12.7	Horizontal	-20.3
320.000	32.6	46.0	-13.4	Horizontal	-19.3
373.320	34.9	46.0	-11.1	Horizontal	-18.0
406.800	31.8	46.0	-14.2	Horizontal	-17.3
426.680	35.6	46.0	-10.4	Horizontal	-16.9
586.680	32.0	46.0	-14.0	Horizontal	-14.2
640.000	34.1	46.0	-11.9	Horizontal	-13.5
800.000	34.5	46.0	-11.5	Horizontal	-11.4
38.976	35.6	40.0	-4.4	Vertical	-20.2
55.874	29.9	40.0	-10.1	Vertical	-27.0
62.895	29.4	40.0	-10.6	Vertical	-27.9
159.999	31.0	43.5	-12.5	Vertical	-22.4
240.000	34.4	46.0	-11.6	Vertical	-21.1
266.640	31.8	46.0	-14.2	Vertical	-20.3
373.320	39.5	46.0	-6.5	Vertical	-18.0
426.680	40.0	46.0	-6.0	Vertical	-16.9
480.000	31.8	46.0	-14.2	Vertical	-15.9
586.680	32.5	46.0	-13.5	Vertical	-14.2
640.000	38.2	46.0	-7.8	Vertical	-13.5
746.640	31.2	46.0	-14.8	Vertical	-12.1
880.000	31.1	46.0	-14.9	Vertical	-10.4

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	Qpeak (dBµV/m) @ 10m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
13.56	84	**18.4**	37.5	**-65.6**	90	V	120	6.3	/

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)	Remark
38.900	20.6	QP	V	0	135	16.7	37.3	40.0	**-2.7**	
55.940	22.3	QP	V	210	155	8.4	30.7	40.0	**-9.3**	
62.810	20.0	QP	V	270	130	7.9	27.9	40.0	**-12.1**	
160.000	25.0	QP	V	0	100	12.8	37.8	43.5	**-5.7**	
240.000	23.3	QP	V	0	110	15.1	38.4	46.0	**-7.6**	
266.660	21.1	QP	V	180	100	16.2	37.3	46.0	**-8.7**	
320.000	19.6	QP	H	270	200	17.4	37.0	46.0	**-9.0**	
373.340	24.8	QP	H	60	175	19.0	43.8	46.0	**-2.2**	
406.800	18.7	QP	H	90	180	20.0	38.7	46.0	**-7.3**	
426.660	24.3	QP	H	45	150	20.5	44.8	46.0	**-1.2**	
480.000	19.0	QP	H	330	160	22.0	41.0	46.0	**-5.0**	
586.660	14.0	QP	V	50	220	24.2	38.2	46.0	**-7.8**	
640.000	17.0	QP	V	20	200	25.3	42.3	46.0	**-3.7**	
746.600	11.5	QP	V	90	220	27.4	38.9	46.0	**-7.1**	
880.000	9.3	QP	V	0	230	29.7	39.0	46.0	**-7.0**	

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 9029, Sn: FR18130154, tested in the configuration presented in this test report **satisfies** to requirements limits of the standard FCC Part 15 Subpart C, for radiated emissions.

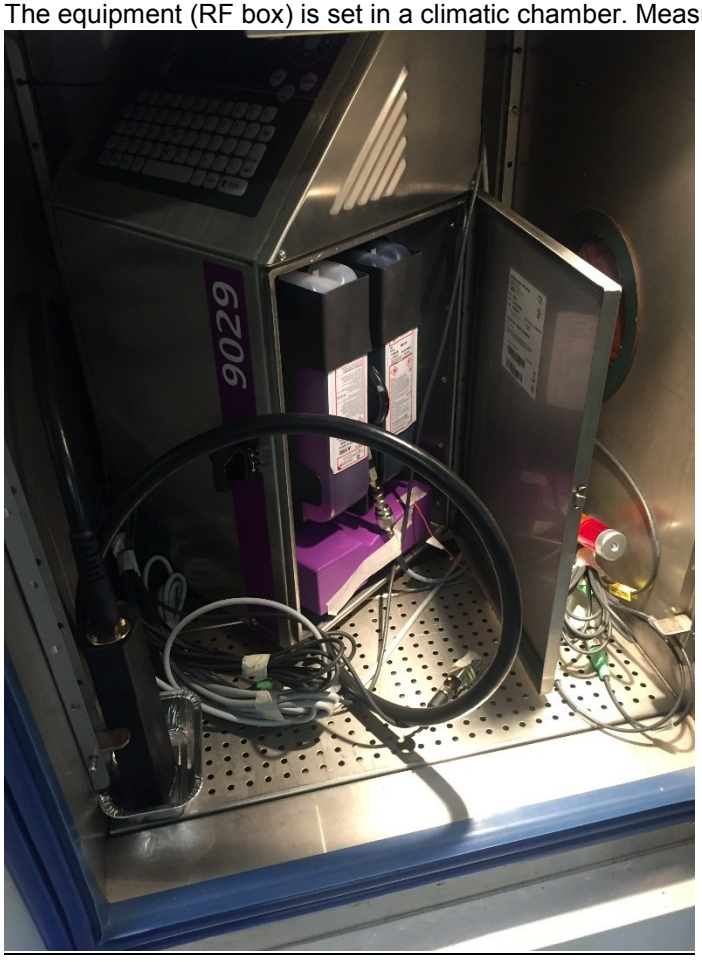
5. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)

5.1. ENVIRONMENTAL CONDITIONS

Date of test	:	April 18, 2018
Test performed by	:	Majid Mourzagh
Atmospheric pressure (hPa)	:	1004
Relative humidity (%)	:	32
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 (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 -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-6993	C2040215	11/17	11/19
Attenuator 10dB	-	-	A7122269	12/17	12/18
Cable SMA	-	18G	A5329373	12/17	12/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D102117	01/00	
AC source	EMTEST	NetWave 20/400	A7043058	05/17	05/18
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18
Thermometer (radio)	FLUKE	52 II	B4043150	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/17	04/18
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/16	08/18

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ Divergence: Temperature range declared by provider for good function, in user manual, is from +5°C to +45°C (possible problem with ink in low temperature).

5.6. TEST RESULTS

Temperature / Voltage	+5°C	+20°C	+45°C
Mains voltage: 110V/60Hz			
Frequency Drift (MHz)	+ 0.000027	**REF**	- 0.000040
Carrier level (dBc)	+ 0.19	**REF**	- 0.14
Mains voltage: 93,5V/60Hz			
Frequency Drift (MHz)	+ 0.000028	- 0.000001	- 0.000040
Carrier level (dBc)	+ 0.21	+ 0.00	- 0.15
Mains voltage: 126V/60Hz			
Frequency Drift (MHz)	+ 0.000028	- 0.000001	- 0.000040
Carrier level (dBc)	+ 0.19	+ 0.00	- 0.17

Frequency drift measured is **40 Hz** when the temperature is varied from +5°C to +45°C and voltage is varied.

5.1. CONCLUSION

The sample of the equipment 9029, Sn: FR18130154, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C, for fundamental frequency tolerance.

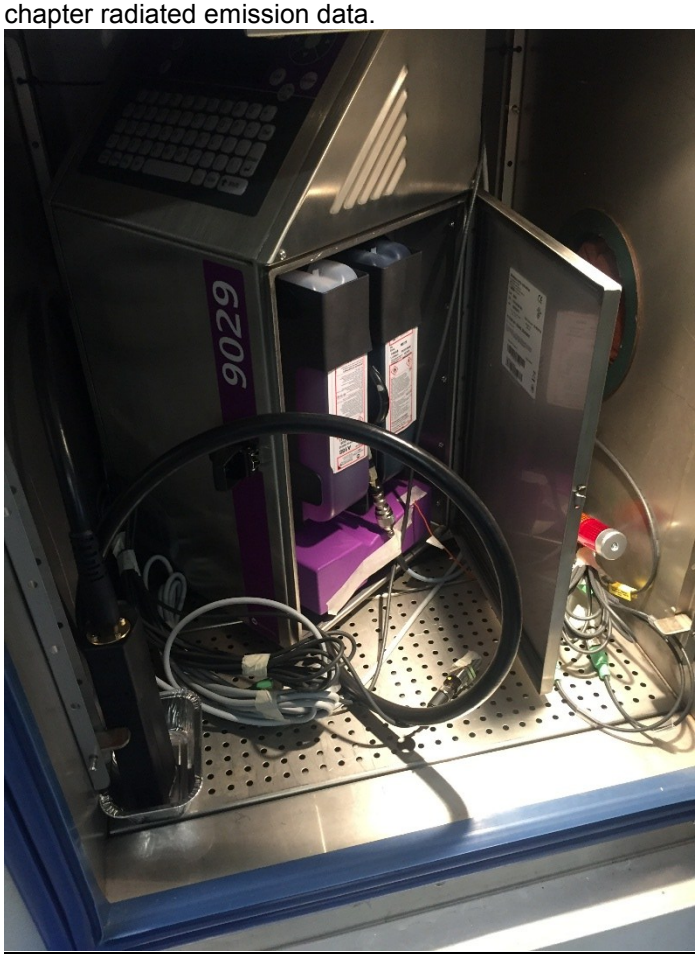
6. BAND-EDGE COMPLIANCE §15.209

6.1. ENVIRONMENTAL CONDITIONS

Date of test	:	April 18, 2018
Test performed by	:	Majid Mourzagh
Atmospheric pressure (hPa)	:	1004
Relative humidity (%)	:	32
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

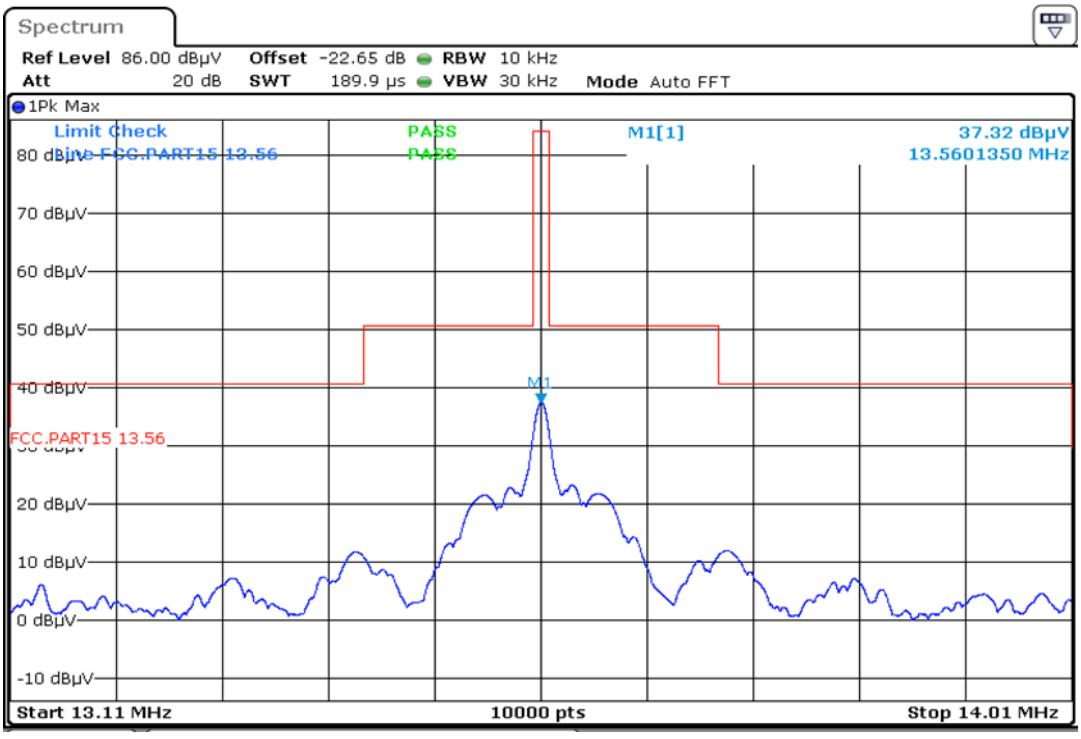
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6993	C2040215	11/17	11/19
Attenuator 10dB	-	-	A7122269	12/17	12/18
Cable SMA	-	18G	A5329373	12/17	12/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D102117	01/00	
AC source	EMTEST	NetWave 20/400	A7043058	05/17	05/18
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18
Thermometer (radio)	FLUKE	52 II	B4043150	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/17	04/18
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/16	08/18

6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

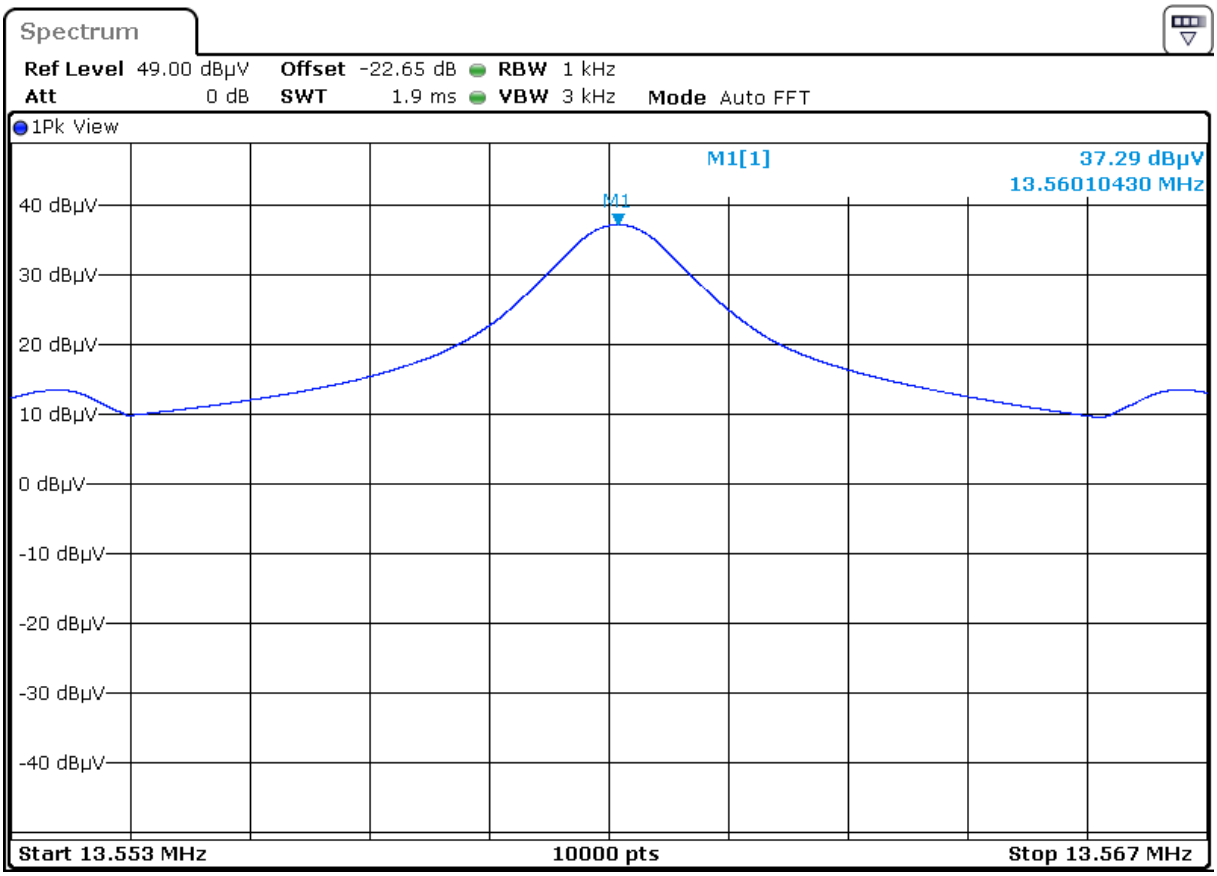
☐ None ☑ Divergence: Power level at 10m (see §4.6), worst case.

6.6. TEST RESULTS

Frequency band 13.110-14.010MHz



Frequency band 13.553-13.567MHz



6.7. CONCLUSION

The sample of the equipment 9029, Sn: FR18130154, 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

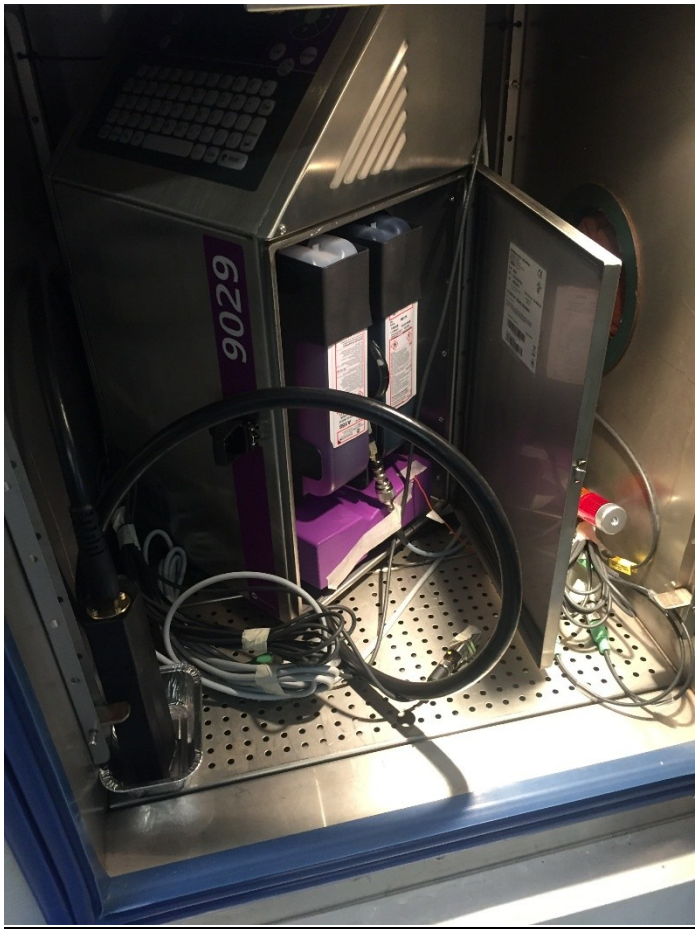
Date of test	:	April 18, 2018
Test performed by	:	Majid Mourzagh
Atmospheric pressure (hPa)	:	1004
Relative humidity (%)	:	32
Ambient temperature (°C)	:	22

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

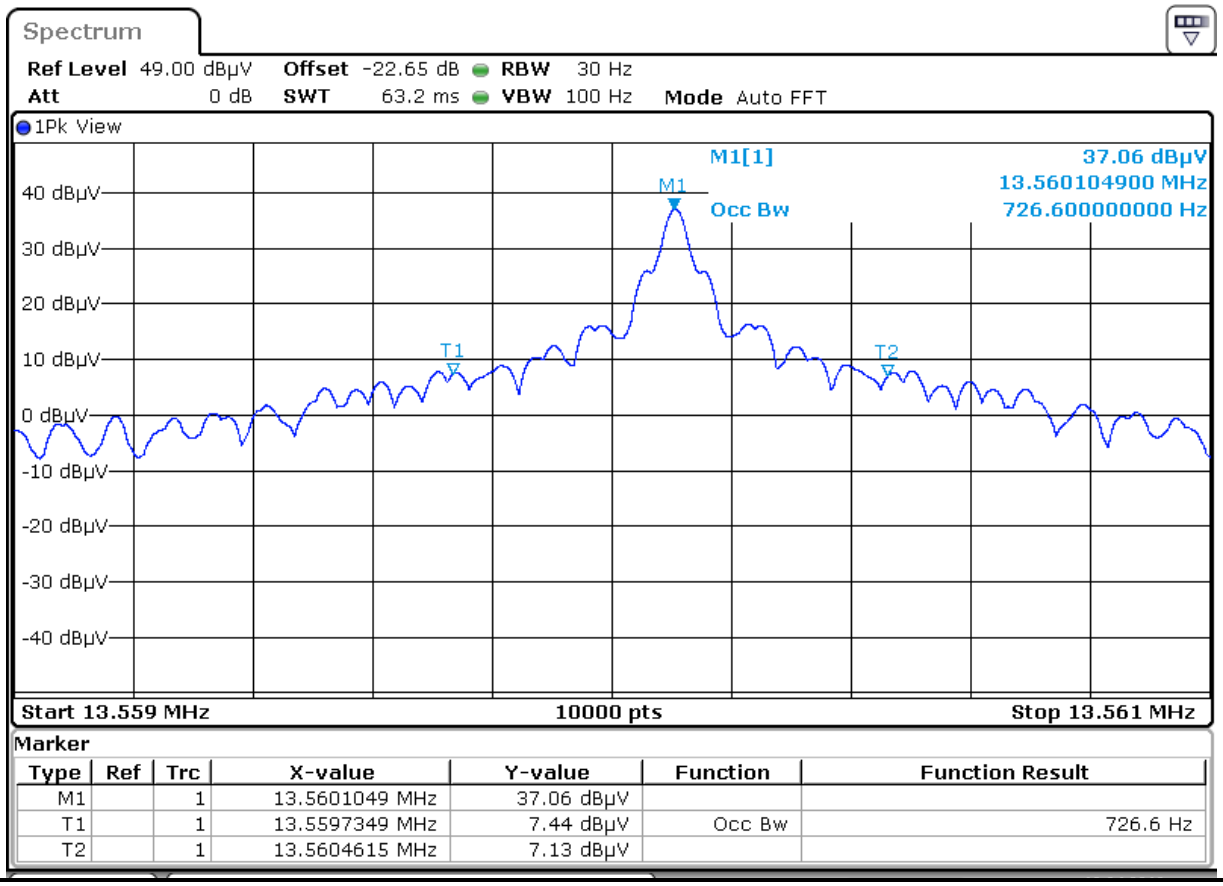
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6993	C2040215	11/17	11/19
Attenuator 10dB	-	-	A7122269	12/17	12/18
Cable SMA	-	18G	A5329373	12/17	12/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D102117	01/00	
AC source	EMTEST	NetWave 20/400	A7043058	05/17	05/18
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18
Thermometer (radio)	FLUKE	52 II	B4043150	04/17	04/18
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/17	04/18
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/16	08/18

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	**726.6**



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 (monophasé /triphasé) 10kHz-150kHz *Measurement of conducted disturbances in voltage on the power port (single & three phases)10kHz-150kHz*	3.27dB	3.8dB
Mesure des perturbations conduites en tension sur le réseau d'énergie (monophasé /triphasé) 150kHz-30MHz *Measurement of conducted disturbances in voltage on the power port (single & three phases)150kHz-30MHz*	3.29dB	3.4dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication *Measurement of conducted disturbances in voltage on the telecommunication port.*	3.26dB	5dB
Mesure des perturbations discontinues conduites en tension *Measurement of discontinuous conducted disturbances in voltage*	3.33dB	3.4dB
Mesure des perturbations conduites en courant *Measurement of conducted disturbances in current*	2.67dB	2.9dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 30MHz à 1GHz *Measurement of radiated electric field in half-anechoic Faraday room From 30MHz to 1GHz*	5.06dB	5.3dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 1GHz à 6GHz *Measurement of radiated electric field in half-anechoic Faraday room From 1GHz à 6GHz*	5.18dB	5.2dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 6GHz à 18GHz *Measurement of radiated electric field in half-anechoic Faraday room From 6GHz to 18GHz*	5.21dB	5.5dB
Mesure du champ électrique rayonné sur le site en espace libre de Moirans 30MHz – 1GHz. *Measurement of radiated electric field on the Moirans open area test site 30MHz – 1GHz.*	5.2dB	6.3dB
Mesure du champ électrique rayonné IN SITU de 30 à 1000 MHz *IN SITU measurement of radiated electric field from 30 to 1000MHz*	A l'étude / Under consideration	5.2dB
Mesure de la puissance perturbatrice *Measurement of disturbance power*	3.32dB	4.5dB
Mesure des harmoniques de courant *Measurement of current harmonics*	11.11%	/
Mesure du flicker *Flicker measurement*	9.26%	/

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par le CISPR, la conformité de l'échantillon est établie directement par les niveaux limites applicables. Ce tableau regroupe l'ensemble des incertitudes maximales pour les essais réalisables dans le laboratoire, qu'ils aient été ou non réalisés dans le cadre du présent rapport */ The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the CISPR. The conformity of the sample is directly established by the applicable limits values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report*

Note - L'incertitude de mesure instrumentale est déterminée selon la CISPR 16-4-2. / *The instrumentation measurement uncertainty is determined according to CISPR16-4-2*