



LCIE

TEST REPORT

N°: 139534-681293-B (REF #871259)

Version : 01

Subject Electromagnetic compatibility tests according to the standards:
FCC CFR 47 Part 15, Subpart C
RSS-210 Issue 8.1

Issued to **INGENICO**
Rovaltain TGV – Quartier de la Gare
26300 Alixan - FRANCE

Apparatus under test

↪ Product	Payment terminal
↪ Trade mark	INGENICO
↪ Manufacturer	INGENICO
↪ Model	IMP352-01T2005A and IMP322-01T2004A
↪ Model under test	IMP352-01T2005A
↪ Serial number	14016PP20133523
↪ FCCID	XKB-IMP3X2
↪ IC	2586D-IMP3X2

Conclusion See Test Program chapter

Test date January 11, 2016 to January 18, 2016

Test location MOIRANS

IC Test site 6500A-1 & 6500A-3

Composition of document 34 pages

Document issued on January 26, 2016

Written by :
Gaetan DESCHAMPS
Tests operator

Approved by :
Anthony MERLIN
Technical manager



This document shall not be reproduced, except in full, without the written approval of the LCIE. This document contains results related only to the items tested. It does not imply the conformity of the whole production to the items tested. Unless otherwise specified, the decision of conformity takes into account the uncertainty of measurement. This document doesn't anticipate any certification decision.

LCIE

Laboratoire Central des Industries Electriques
Une société de Bureau Veritas

ZI Centr'alp
170 rue de Chatagnon
38430 Moirans FRANCE

Tél : +33 4 76 07 36 36
contact@lcie.fr
www.lcie.fr



PUBLICATION HISTORY

Version	Date	Author	Modification
01	January 26, 2016	Gaëtan Deschamps	Creation of the document



SUMMARY

1. TEST PROGRAM.....	4
2. SYSTEM TEST CONFIGURATION	5
3. CONDUCTED EMISSION DATA	8
4. RADIATED EMISSION DATA (15.209).....	11
5. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E).....	16
6. BAND-EDGE COMPLIANCE §15.209	18
7. OCCUPIED BANDWIDTH	20
8. ANNEX 1 (GRAPHS).....	22
9. UNCERTAINTIES CHART	34



1. TEST PROGRAM

Standard:

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

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance at mains ports 150kHz-30MHz CFR 47 §15.207	Frequency	Quasi-peak value (dBµV)	Average value (dBµV)	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> 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			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Radiated emissions 30MHz-25GHz* CFR 47 §15.209 (a) CFR 47 §15.225 RSS-Gen §4.9 <i>Highest frequency : 2.4GHz (Declaration of provider)</i>	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			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Fundamental field strength limit CFR 47 §15.225 RSS-210 §A2.6	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Fundamental frequency tolerance CFR 47 §15.225 RSS-210 §A2.6	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Band edge compliance CFR 47 §15.225 RSS-210 §A2.6	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Occupied bandwidth RSS-Gen §4.6.1	No limit			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Receiver Spurious Emission** RSS-Gen §4.10	See RSS-Gen §4.10			<input type="checkbox"/> PASS <input type="checkbox"/> FAIL <input checked="" type="checkbox"/> NA <input type="checkbox"/> 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 EUT

There are different hardware versions (with or without barcode) with different activation software:

- IMP322-01T2004A (No barcode / With Contact less / With Bluetooth)
- IMP352-01T2005A (With barcode / With Contact less / With Bluetooth) Full options (EUT)

For this report the Full option is tested because the others hardware versions are the same family range.

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):

IMP352-01T2005A

Serial Number: 14016PP20133523



Photography of EUT

Power supply:

During all the tests, EUT is supplied by V_{nom} : 5VDC

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

Name	Type	Rating	Part number / Model	Comments
Supply1	<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC <input type="checkbox"/> Battery	100-240VAC to 5VDC, 50-60Hz and 300mA to 1A	192049372 / PSM05R-050I	Used in configuration 1 (see §2.2)
Supply2	<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC <input type="checkbox"/> Battery	100-240VAC to 5VDC, 50-60Hz and 300mA to 2A	192050007 / PSM10R-050I	Used in configuration 2 (see §2.2)
Battery	<input type="checkbox"/> AC <input type="checkbox"/> DC <input checked="" type="checkbox"/> Battery	3.7Vdc	296118442	Internal



Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	Mini USB	1.2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
Supply2	Jack	1.2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
Access1	COM 0	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Ipod	Touch	-	-
Contact less Card	-	-	-
COM 0 Card	-	-	-

Equipment information:

RF module:			
Frequency band:	<input checked="" type="checkbox"/> [13.553–13.567]MHz	<input type="checkbox"/> [125]kHz	<input type="checkbox"/> Other:[-]MHz
RF mode:	<input type="checkbox"/> Transmitter	<input checked="" type="checkbox"/> Transceiver	<input type="checkbox"/> Receiver <input type="checkbox"/> Standby
Type:	<input checked="" type="checkbox"/> RFID	<input type="checkbox"/> EAS	<input type="checkbox"/> WPT <input type="checkbox"/> Other:
Bandwidth:	<input checked="" type="checkbox"/> Narrowband (ISO15693, ISO18000-3...)	<input type="checkbox"/> Wideband (ISO14443, NFC...)	
Antenna type:	<input type="checkbox"/> External:		<input checked="" type="checkbox"/> Internal:
Antenna gain:	0dBi		
Type of equipment:	<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in	<input type="checkbox"/> Combined
Duty cycle:	<input checked="" type="checkbox"/> Continuous duty	<input type="checkbox"/> Intermittent duty	<input type="checkbox"/> 100% duty
Equipment type:	<input checked="" type="checkbox"/> Production model		<input type="checkbox"/> Pre-production model
Operating temperature range:	Tmin:	<input checked="" type="checkbox"/> -30°C	<input type="checkbox"/> 0°C <input type="checkbox"/> X°C
	Tnom:	20°C	
	Tmax:	<input type="checkbox"/> 35°C	<input checked="" type="checkbox"/> 55°C <input type="checkbox"/> X°C
Type of power source:	<input checked="" type="checkbox"/> AC power supply	<input type="checkbox"/> DC power supply	<input type="checkbox"/> Battery



2.3. EUT CONFIGURATION

There are two configurations tests.

Configuration 1:

The EUT is powered by supply1, the contact less is activated with read/write on COM 0 and Bluetooth mode (communication between EUT and IPod).

Configuration 2:

The EUT is powered by supply2 in mode reload only. This mode is tested only in Conducted emission data and radiated emission data.

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 52.5dB μ V 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 dB μ V/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$

The 32 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32\text{dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m.}$$

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 18, 2016
Test performed by : Jonathan Sarto
Atmospheric pressure (hPa) : 999
Relative humidity (%) : 30
Ambient temperature (°C) : 22

3.2. TEST SETUP

Mains terminals

The EUT and auxiliaries are set:

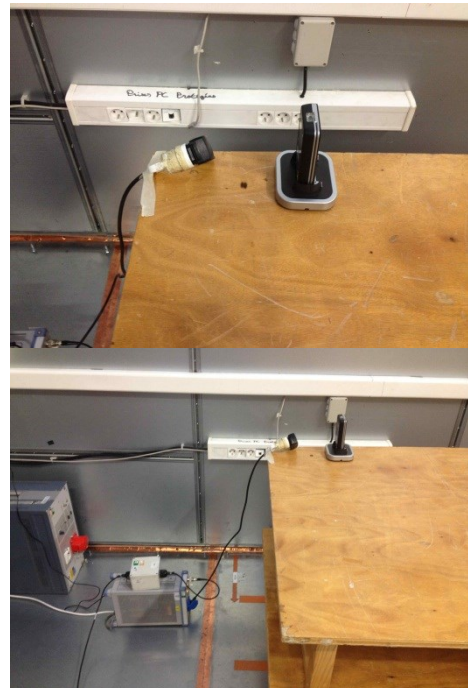
80cm above the ground on the non-conducting table (Table-top equipment)

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

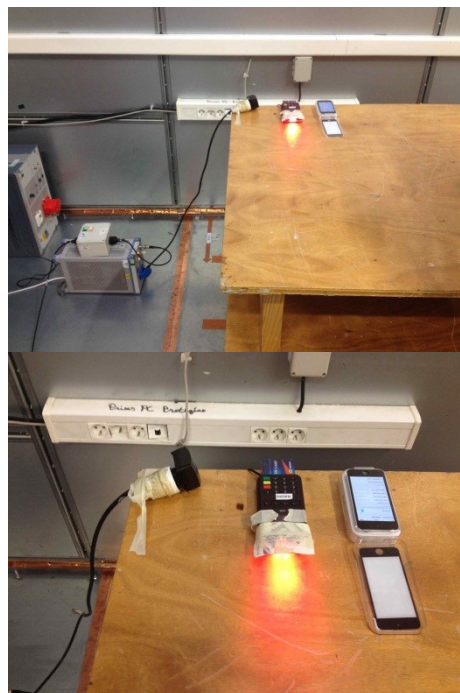
The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane.

The EUT is powered by V_{nom} .

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



Test setup in configuration 2



Test setup in configuration 1 :

3.3. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + self	-	-	A5329578	07/15	07/16
Conducted emission comb generator	BARDET	-	A3169049	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320291	11/15	11/16
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	04/15	04/16
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	09/15	09/16
Transient limiter	HEWLETT PACKARD	11947A	A4049061	02/15	02/16

3.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

Divergence:



3.5. TEST RESULTS

Mains terminals:

Supply1

Measurements are performed on the phase (L1) and neutral (N) of the power line.

Results: (PEAK detection)

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

Supply2

Measurements are performed on the phase (L1) and neutral (N) of the power line.

Results: (PEAK detection)

Graph identifier	Line	Comments
Emc# 3	Phase	- See annex 1
Emc# 4	Neutral	- See annex 1

3.6. CONCLUSION

Conducted emission data measurement performed on the sample of the product **IMP352-01T2005A**, SN: **14016PP20133523**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.

4. RADIATED EMISSION DATA (15.209)

4.1. ENVIRONMENTAL CONDITIONS

Date of test : January 5, 2016
 Test performed by : Gaëtan DESCHAMPS
 Atmospheric pressure (hPa) : 999
 Relative humidity (%) : 30
 Ambient temperature (°C) : 22

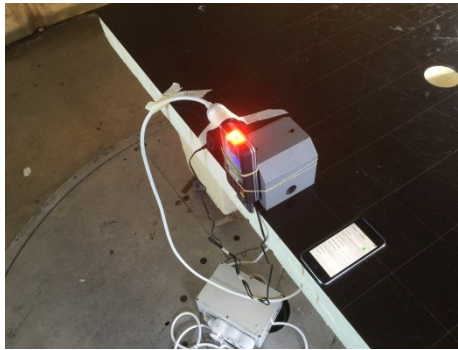
4.2. TEST SETUP

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.

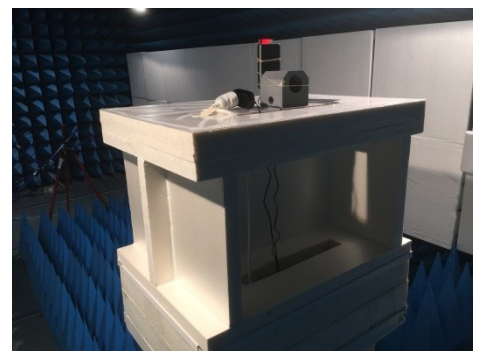
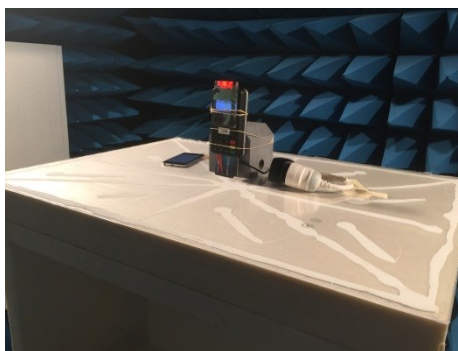
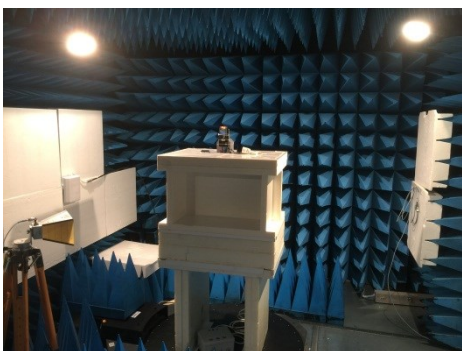
The EUT and auxiliaries are set:

- 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} .



General Test setup on OATS worst case presented (30MHz to 1GHz, configuration 1, same setup for configuration 2)



General Test setup in anechoic chamber worst case presented (1GHz to 6GHz, configuration 1, same setup for configuration 2)



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.



L C I E

4.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Bi-log	CHASE	CBL6111A	C2040051	04/14	04/16
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/15	11/17
Antenna Bi-log	CHASE	CBL6111A	C2040172	06/15	06/17
Antenna horn	EMCO	3115	C2042027	11/15	11/16
Cable Measure @3m 18GHz	-	-	A5329038	08/15	08/16
Cable	SUCOFLEX	106G	A5329061	03/15	03/16
Cable Measure @3m	-	-	A5329206	04/15	04/16
Cable + self	-	-	A5329578	07/15	07/16
Cable (OATS)	-	-	A5329623	10/15	10/16
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	04/13	04/16
Conducted emission comb generator	BARDET	-	A3169049	-	-
Radiated emission comb generator	BARDET	-	A3169050	-	-
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088	-	-
LISN	SCHWARZBECK	NSLK 8127-PLC	C2320091	06/15	06/16
LISN	RHODE & SCHWARZ	ENV216	C2320291	11/15	11/16
OATS	-	-	F2000409	06/15	06/16
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	04/15	04/16
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	01/15	01/16
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	04/15	04/16
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	09/15	09/16
Transient limiter	HEWLETT PACKARD	11947A	A4049061	02/15	02/16
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	-	-

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] only performed for configuration1:

See graph for 9kHz-30MHz band:

Graph identifier	Polarization	EUT position	Comments
Emr# 1	0°	Axis Z	Configuration 1 See annex 1
Emr# 2	90°	Axis Z	Configuration 1 See annex 1
Emr# 3	0°	Axis Z	Configuration 2 See annex 1
Emr# 4	90°	Axis Z	Configuration 2 See annex 1

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

See graphs for 30MHz-1GHz:

Graph identifier	Polarization	EUT position	Comments
Emr# 3	H/V	Axis Z	Configuration 1 See annex 1
Emr# 4	H/V	Axis Z	Configuration 2 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# 5	H/V	Axis Z	Configuration 1 See annex 1
Emr# 6	H/V	Axis Z	Configuration 2 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 (dB μ V/m) @ 30m	Qpeak (dB μ V/m) @ 30m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
	13.56	84	33.0	-51.0	95	0°	115	35.1	-
	27.12	29.5	19.7	-9.8	270	0°	100	44.7	-

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 (μ V/m)	Measurement distance (m)
13.553-13.567	15 848 84 dB μ V/m	30
13.410-13.553 13.567-13.710	334 50.5 dB μ V/m	30
13.110-13.410 13.710-14.010	106 40.5 dB μ V/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.

Configuration 1:

No	Frequency (MHz)	Limit QPeak (dBµV/m)	Measure QPeak (dBµV/m)	Margin QPeak (dB)	Angle Table (°)	Pol. Ant.	Ht. Ant. (cm)	FC (dB)	Remark
1	39.197	40.0	32.8	-7.2	0	V	100	14.7	
2	54.240	40.0	33.8	-6.2	85	V	100	8.6	
3	98.799	43.5	29.0	-14.5	0	V	100	11.7	*
4	117.346	43.5	36.6	-6.9	130	V	250	13.5	
5	151.312	43.5	34.6	-8.9	195	V	250	13.2	
6	250.000	46.0	37.8	-8.2	115	V	305	15.3	
7	338.760	46.0	37.3	-8.7	0	H	390	17.4	
8	375.010	46.0	43.8	-2.2	240	H	250	18.7	
9	425.040	46.0	38.0	-8.0	119	V	395	19.8	
10	531.840	46.0	33.3	-12.7	0	H	250	22.8	

Configuration 2:

No	Frequency (MHz)	Limit QPeak (dBµV/m)	Measure QPeak (dBµV/m)	Margin QPeak (dB)	Angle Table (°)	Pol. Ant.	Ht. Ant. (cm)	FC (dB)	Remark
1	39.197	40.0	32.8	-7.2	0	V	100	14.7	
2	53.545	40.0	36.8	-3.2	75	V	100	8.8	
3	67.179	40.0	32.4	-7.6	0	V	100	7.8	
4	290.280	46.0	41.3	-4.7	300	V	110	16.2	
5	338.480	46.0	34.6	-11.4	66	V	250	17.4	
6	387.080	46.0	39.0	-7.0	310	H	250	19.2	
7	497.320	46.0	33.4	-12.6	0	V	250	21.9	

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

*Measure performed in full anechoic room.

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, margin > 10dB.

Note: Measures have been done at 3m distance.

4.7. CONCLUSION

The sample of the equipment **IMP352-01T2005A**, Sn: 14016PP20133523, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part15B and C, for radiated emissions.

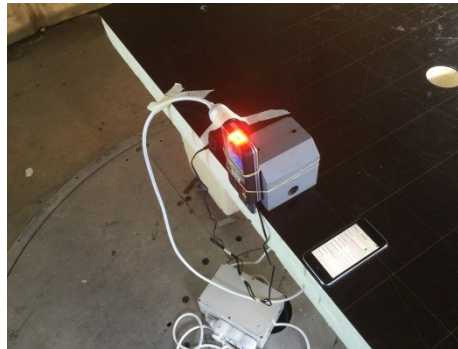
5. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)

5.1. ENVIRONMENTAL CONDITIONS

Date of test : January 6, 2016
Test performed by : Gaëtan DESCHAMPS
Atmospheric pressure (hPa) : 999
Relative humidity (%) : 30
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 $\pm 0.01\%$ of the operating frequency when the temperature is varied from -20°C to $+50^{\circ}\text{C}$ 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
Antenna Loop	ELECTRO-METRICS	EM-6993	C2040210	09/15	09/16
Cable substitution	-	-	A5329059	12/15	12/16
Cable SMA	-	18G	A5329373	10/15	10/16
Cable (OATS)	-	-	A5329623	10/15	10/16
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	12/15	12/16
OATS	-	-	F2000409	06/15	06/16
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	04/15	04/16
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	11/15	11/16
Thermometer (radio)	FLUKE	52 II	B4043150	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	09/15	09/16
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	-	-

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

5.6. TEST RESULTS

Voltage	Temperature			
	-30°C	-20°C	20°C	+55°C
Mains voltage: 110V/60Hz				
Frequency Drift (MHz)	+ 0.000060	+ 0.000060	REF	+ 0.000080
Carrier level (dBc)	- 1.12	- 1.12	REF	+ 0.22
Mains voltage: 93,5V/60Hz				
Frequency Drift (MHz)	+ 0.000050	+ 0.000050	+ 0.000000	+ 0.000090
Carrier level (dBc)	- 1.41	- 1.41	+ 0.00	+ 0.18
Mains voltage: 126V/60Hz				
Frequency Drift (MHz)	+ 0.000080	+ 0.000080	+ 0.000000	+ 0.000070
Carrier level (dBc)	- 1.28	- 1.28	- 0.07	- 0.03

Frequency drift measured is **90Hz** when the temperature is varied from -30°C to +55°C and voltage is varied.

5.1. CONCLUSION

The sample of the equipment **IMP352-01T2005A**, Sn: 14016PP20133523, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part15C, for fundamental frequency tolerance.

6. BAND-EDGE COMPLIANCE §15.209

6.1. ENVIRONMENTAL CONDITIONS

Date of test : January 6, 2016
 Test performed by : Gaëtan DESCHAMPS
 Atmospheric pressure (hPa) : 999
 Relative humidity (%) : 30
 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.

6.4. TEST EQUIPMENT LIST

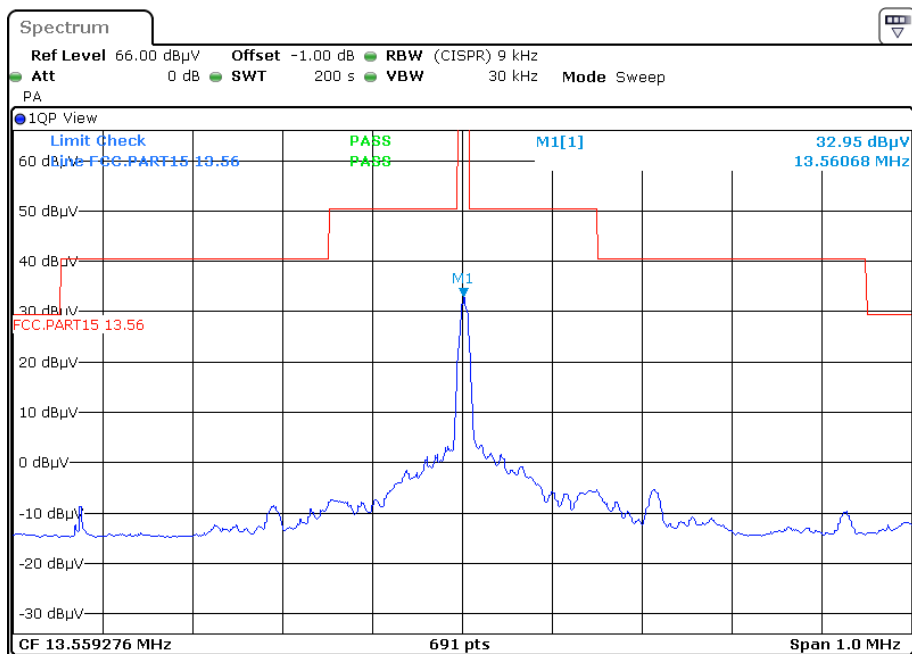
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/15	11/17
Cable substitution	-	-	A5329059	12/15	12/16
Cable SMA	-	18G	A5329373	10/15	10/16
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	12/15	12/16
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	11/15	11/16
Thermometer (radio)	FLUKE	52 II	B4043150	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	09/15	09/16

6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

6.6. TEST RESULTS

Frequency band 13.110-14.010MHz



6.7. CONCLUSION

The sample of the equipment **IMP352-01T2005A**, Sn: 14016PP20133523, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part15C, for band-edge compliance.



7. OCCUPIED BANDWIDTH

7.1. ENVIRONMENTAL CONDITIONS

Date of test : January 6, 2016
Test performed by : Gaëtan DESCHAMPS
Atmospheric pressure (hPa) : 999
Relative humidity (%) : 30
Ambient temperature (°C) : 22

7.1. SETUP

Conducted measurement:

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

Radiated measurement:

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

Measurement Procedure:

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

7.2. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/15	11/17
Cable substitution	-	-	A5329059	12/15	12/16
Cable SMA	-	18G	A5329373	10/15	10/16
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	12/15	12/16
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	11/15	11/16
Thermometer (radio)	FLUKE	52 II	B4043150	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	09/15	09/16

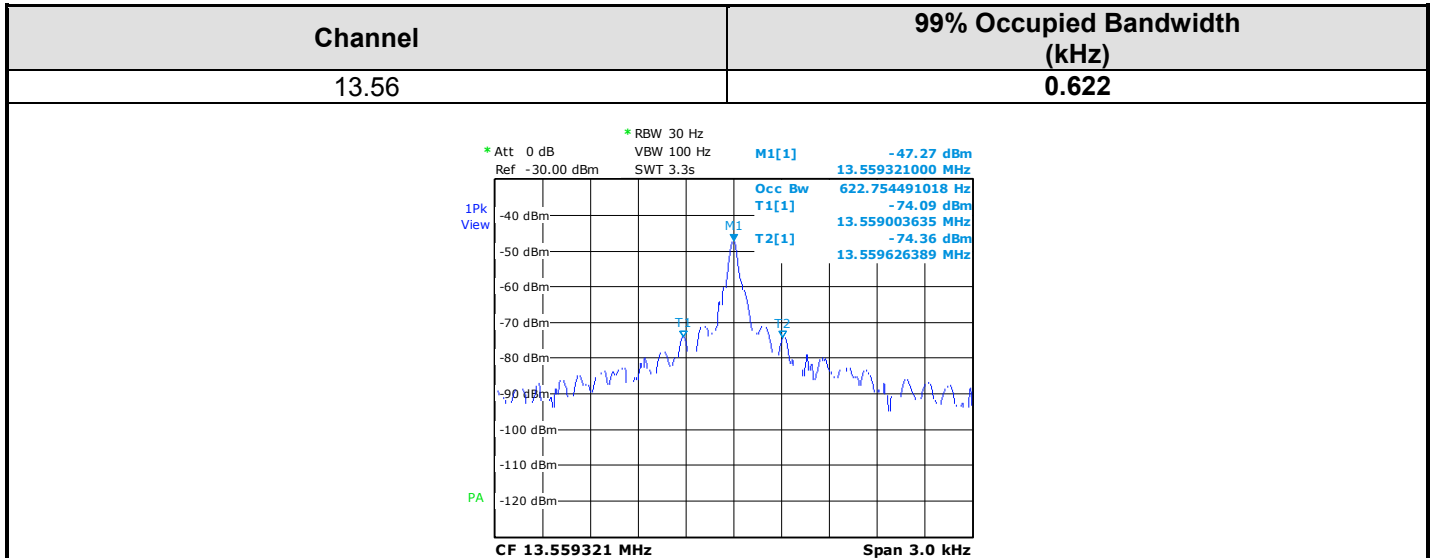
7.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:



L C I E

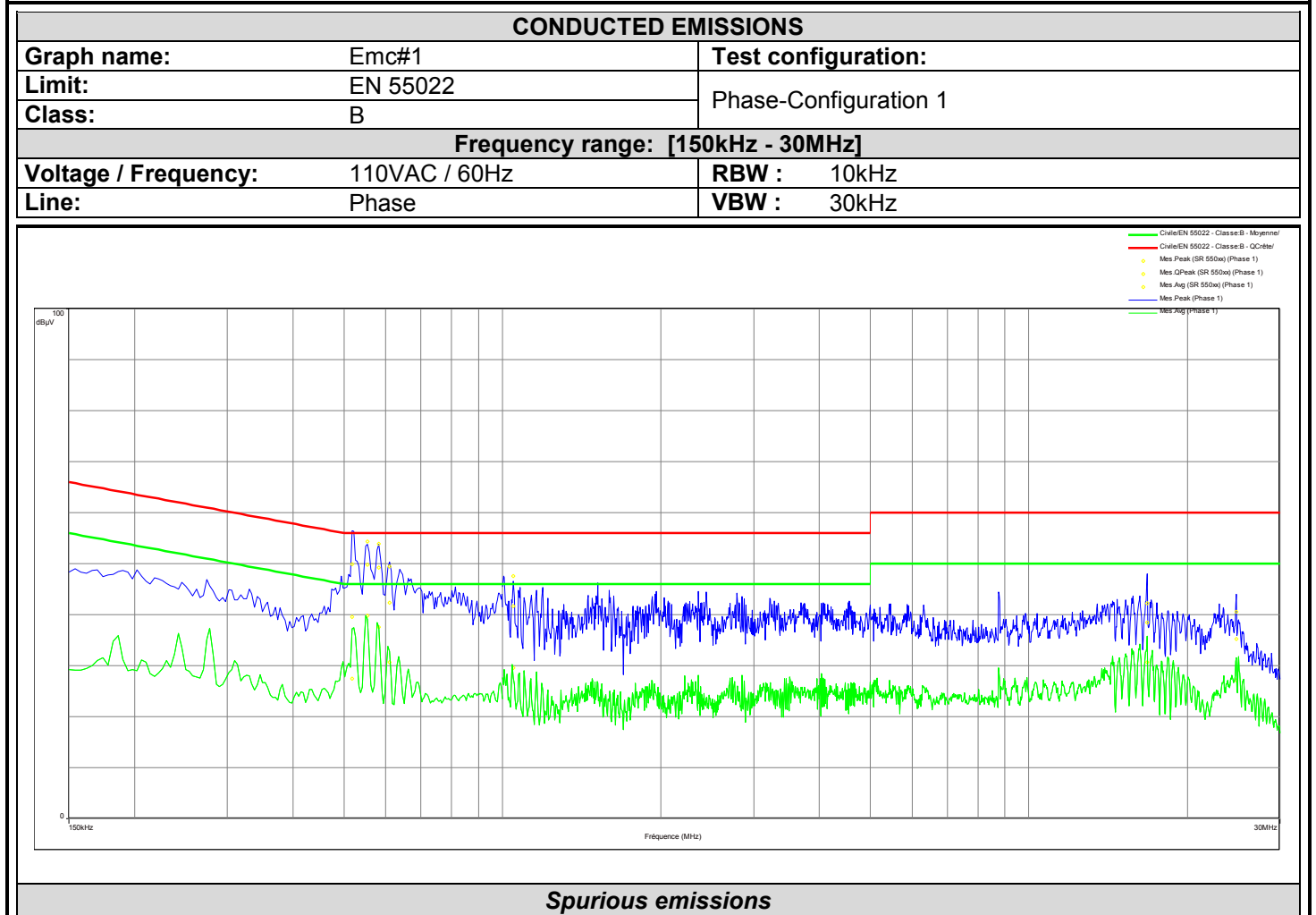
7.4. TEST SEQUENCE AND RESULTS





L C I E

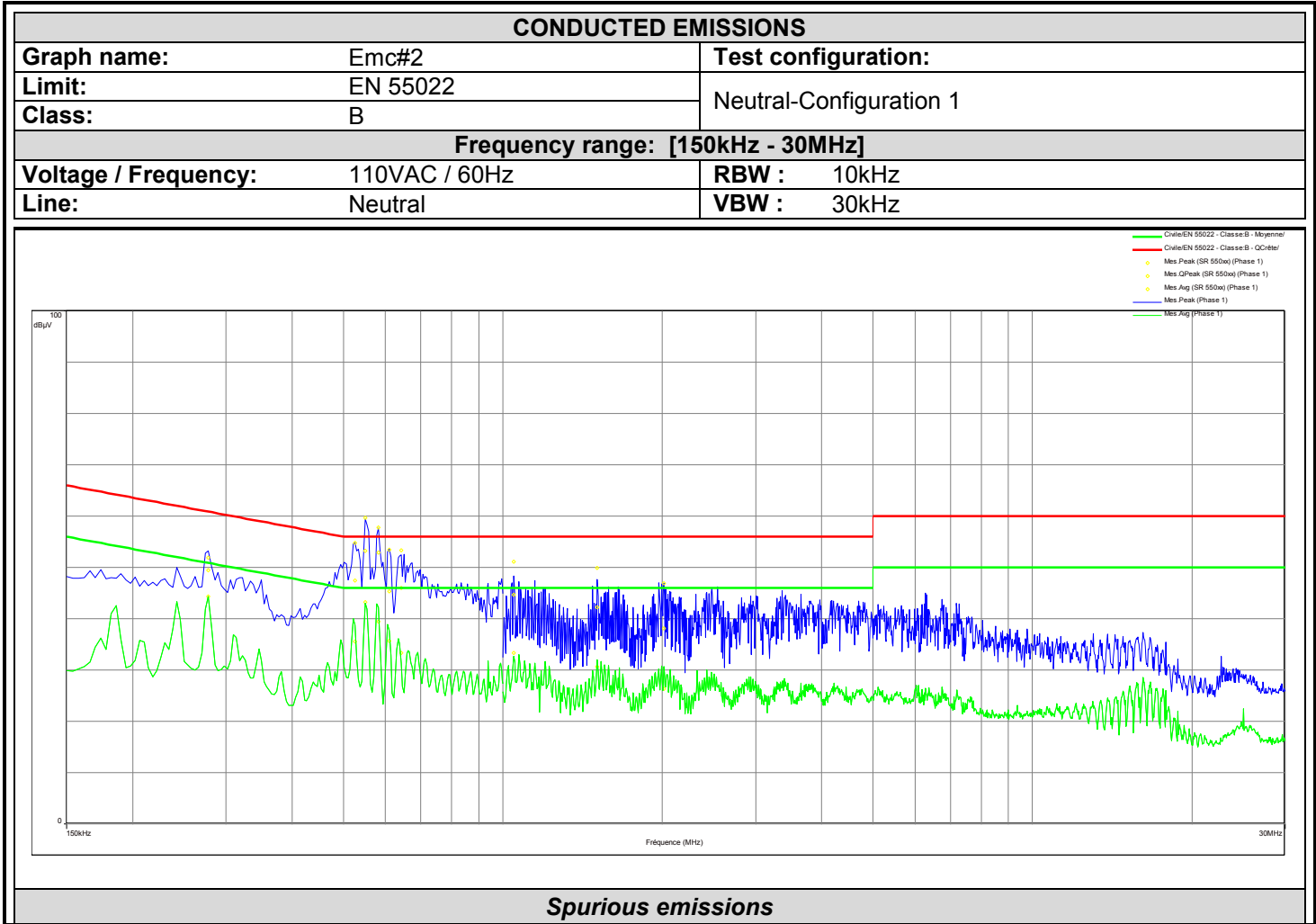
8. ANNEX 1 (GRAPHS)



Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.518	49.87	39.57	56	-16.43	27.42	46	-18.58
0.554	54.35	49.77	56	-6.23	39.8	46	-6.2
0.582	53.94	49.21	56	-6.79	37.54	46	-8.46
0.61	49.41	42.33	56	-13.67	30.65	46	-15.35
1.048	47.57	41.65	56	-14.35	29.55	46	-16.45
16.768	42.24	38.41	60	-21.59	30.7	50	-19.3
24.752	40.6	35.27	60	-24.73	27.14	50	-22.86



L C I E



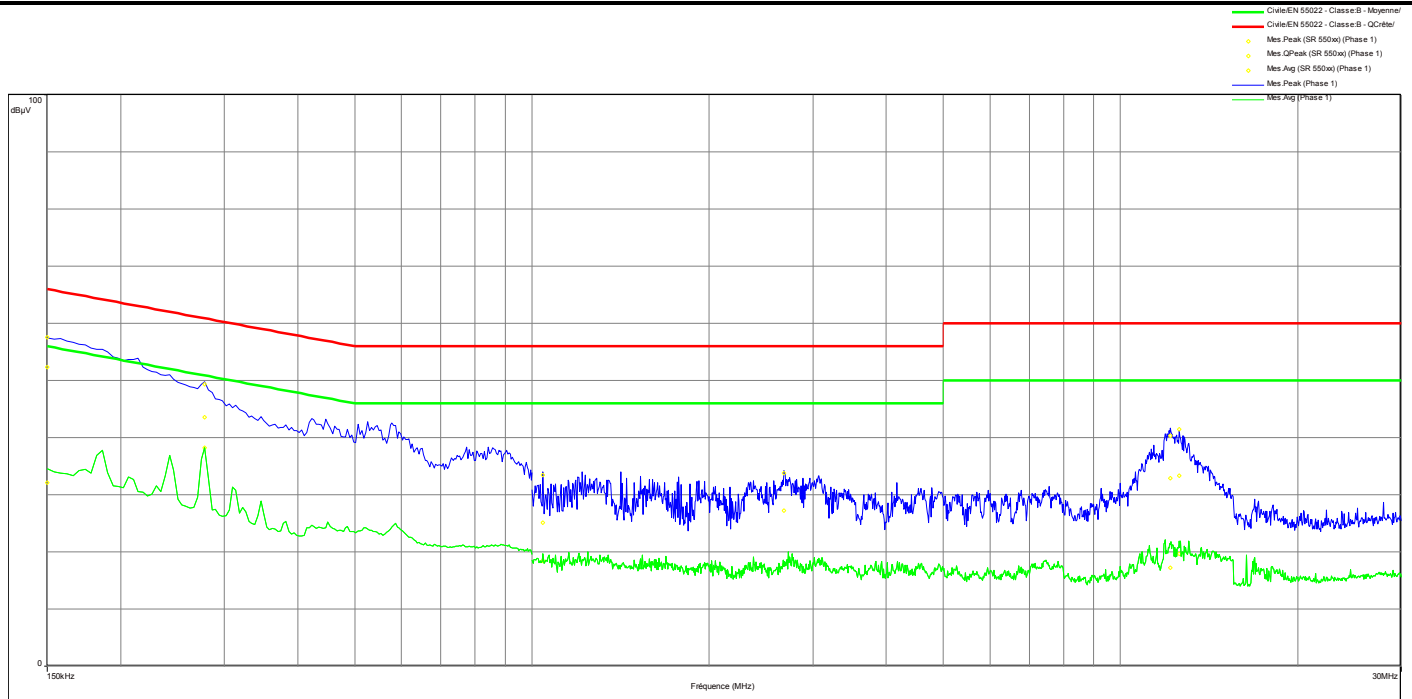
Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.278	51.87	49.49	60.88	-11.39	44.36	50.88	-6.52
0.526	54.74	47.45	56	-8.55	35.54	46	-10.46
0.55	59.69	53.2	56	-2.8	43.23	46	-2.77
0.582	57.75	52.91	56	-3.09	39.42	46	-6.58
0.61	53.49	45.29	56	-10.71	35.71	46	-10.29
0.642	53.35	45.97	56	-10.03	33.34	46	-12.66
1.048	51.13	44.69	56	-11.31	33.34	46	-12.66
1.508	49.86	42.21	56	-13.79	30.71	46	-15.29
2.016	46.89	38.13	56	-17.87	26.38	46	-19.62



L C I E

CONDUCTED EMISSIONS

Graph name:	Emc#3	Test configuration:	
Limit:	EN 55022	Phase-Configuration 2	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	110VAC / 60Hz	RBW :	10kHz
Line:	Phase	VBW :	30kHz



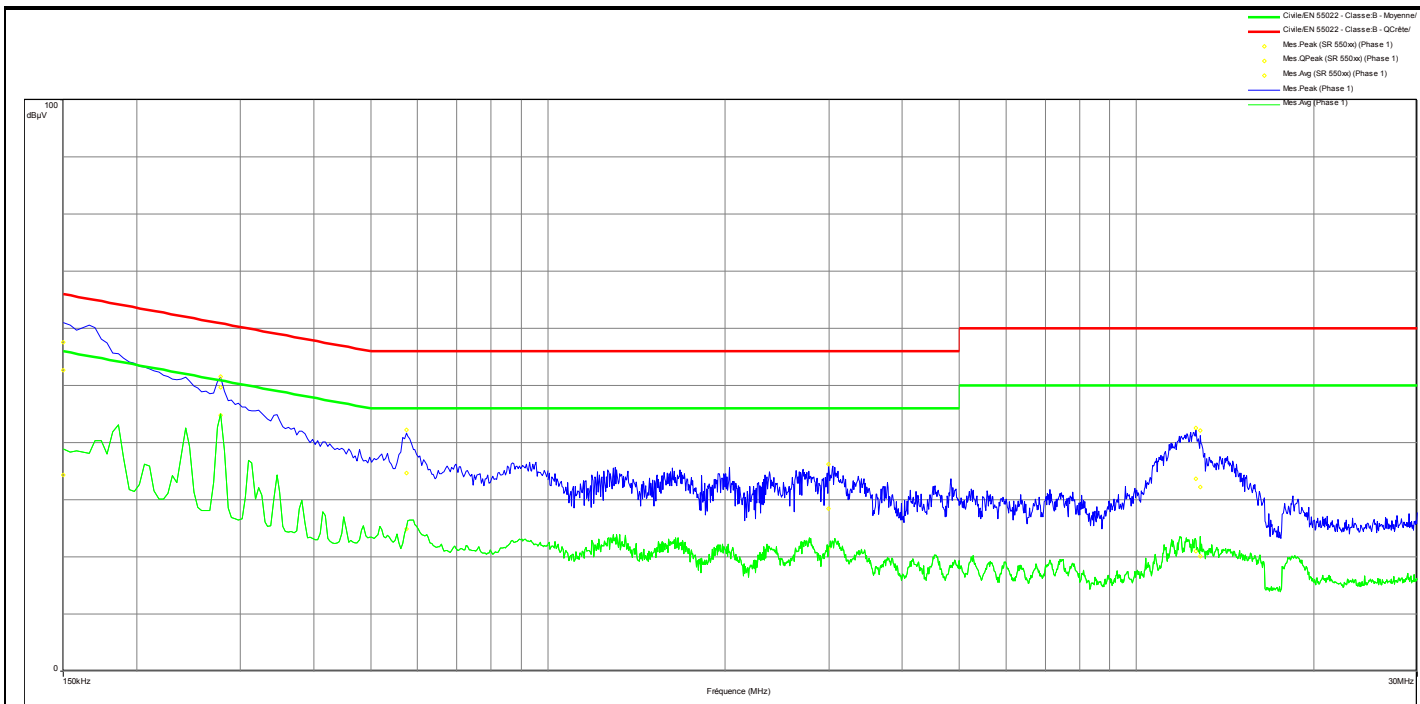
Spurious emissions

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.15	57.55	52.37	66	-13.63	32.12	56	-23.88
0.278	49.35	43.6	60.88	-17.28	38.2	50.88	-12.68
1.044	33.39	25.16	56	-30.84	18.48	46	-27.52
2.68	33.74	27.25	56	-28.75	17.76	46	-28.24
12.148	40.3	32.85	60	-27.15	17.24	50	-32.76
12.576	41.39	33.29	60	-26.71	19.68	50	-30.32



L C I E

CONDUCTED EMISSIONS		
Graph name:	Emc#4	Test configuration:
Limit:	EN 55022	Neutral-Configuration 2
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)
0.15	57.55	52.7	66	-13.3	34.3	56	-21.7
0.278	51.55	49.71	60.88	-11.17	44.79	50.88	-6.08
0.574	42.23	34.64	56	-21.36	24.85	46	-21.15
2.996	36.23	28.47	56	-27.53	21.41	46	-24.59
12.6	42.52	33.65	60	-26.35	20.99	50	-29.01
12.844	42.09	32.22	60	-27.78	20.14	50	-29.86

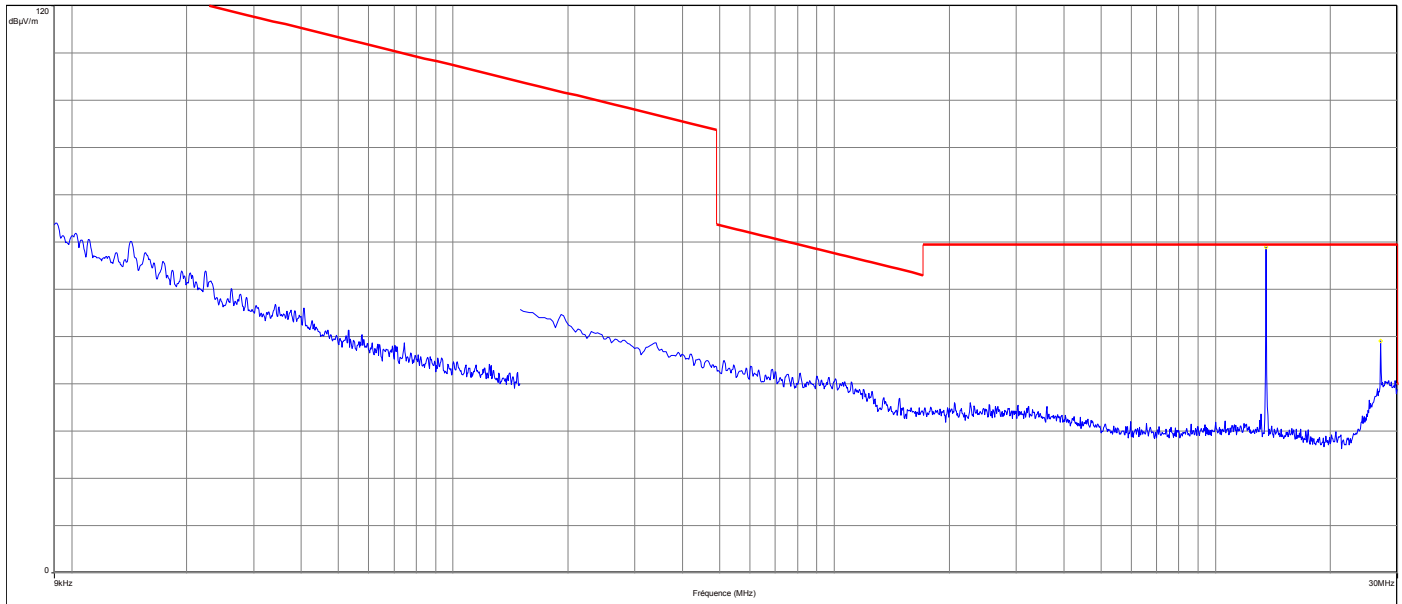


L C I E

RADIATED EMISSIONS

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

- FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
- Niveau (Suspect Manuel) (Horizontale)
- Mes.Peak (Horizontale)



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)
13.55862	68.92
27.119475	49.05

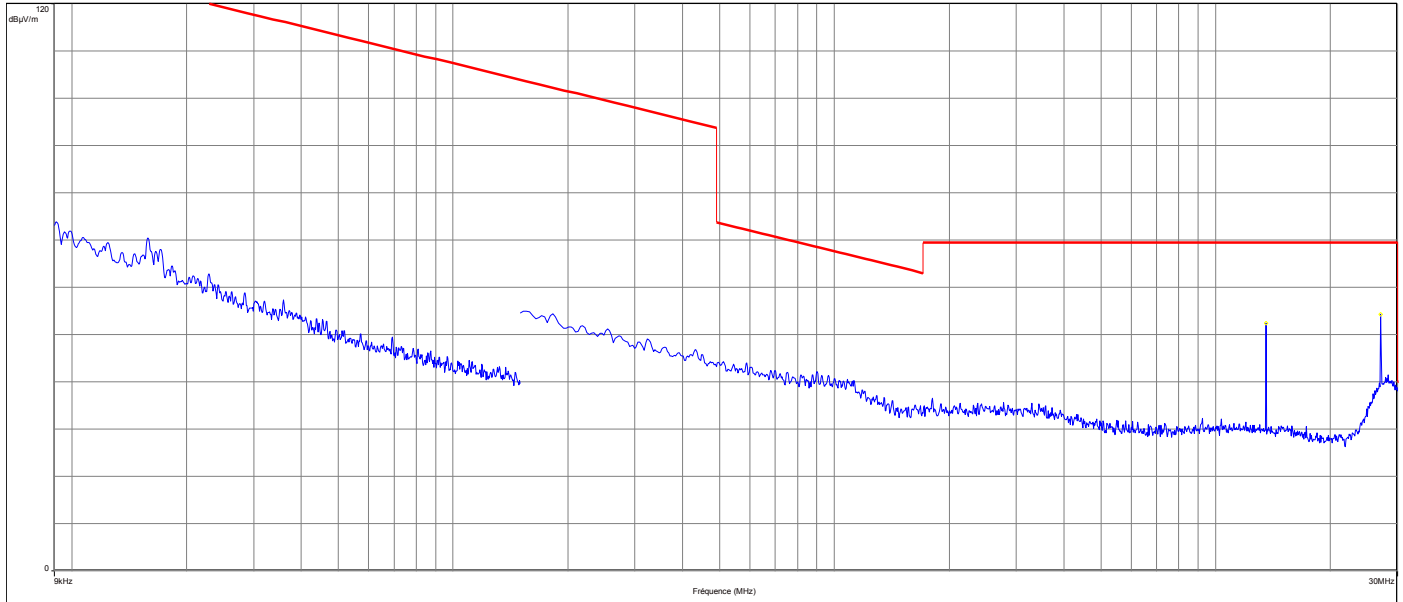


L C I E

RADIATED EMISSIONS

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

- FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
- Niveau (Suspect Manuel) (Horizontale)
- Mes.Peak (Horizontale)



Spurious emissions

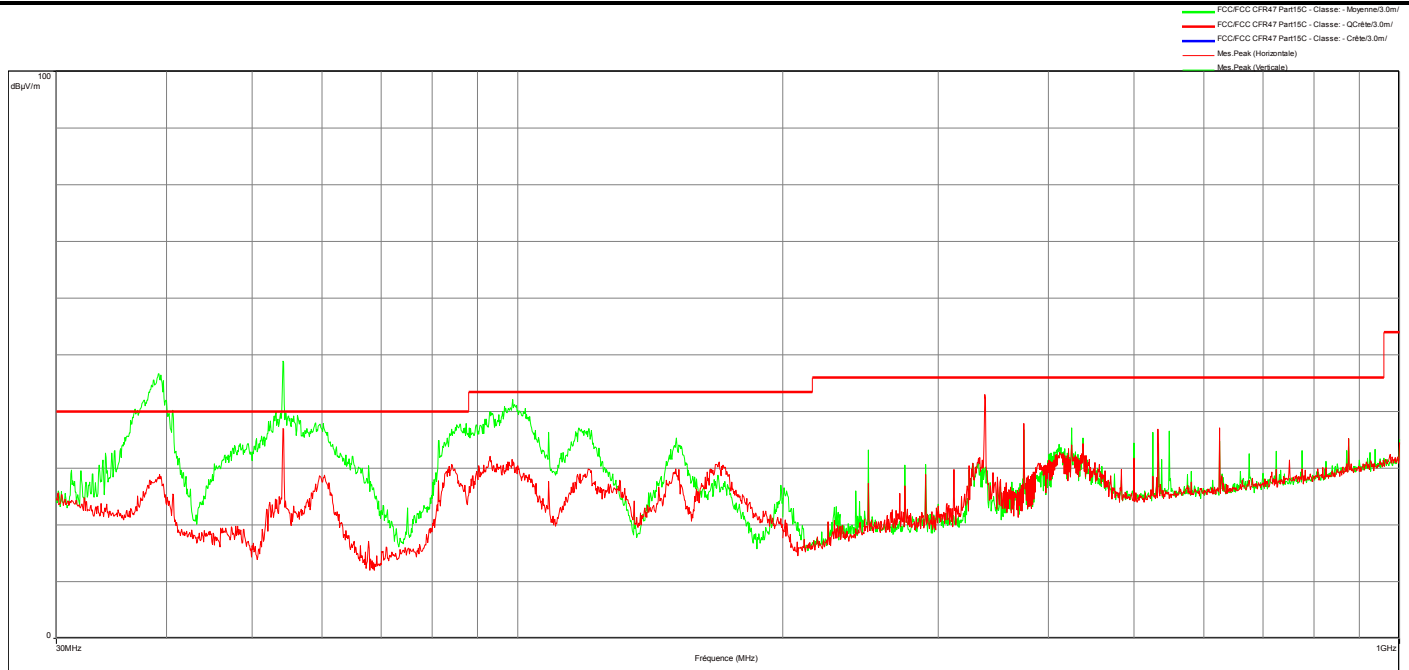
Frequency (MHz)	Peak (dBµV/m)
13.55862	52.4
27.119475	54.3



L C I E

RADIATED EMISSIONS

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



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Position
39.282	28.84	Horizontal
54.242	36.97	Horizontal
60.43	28.74	Horizontal
93.087	32.14	Horizontal
120.253	29.93	Horizontal
151.074	29.88	Horizontal
169.179	31.06	Horizontal
338	36.16	Horizontal
338.76	42.96	Horizontal
375.04	37.94	Horizontal
437.52	34.31	Horizontal
531.88	36.9	Horizontal
532.44	33.14	Horizontal
625	37.13	Horizontal
875.04	35.19	Horizontal

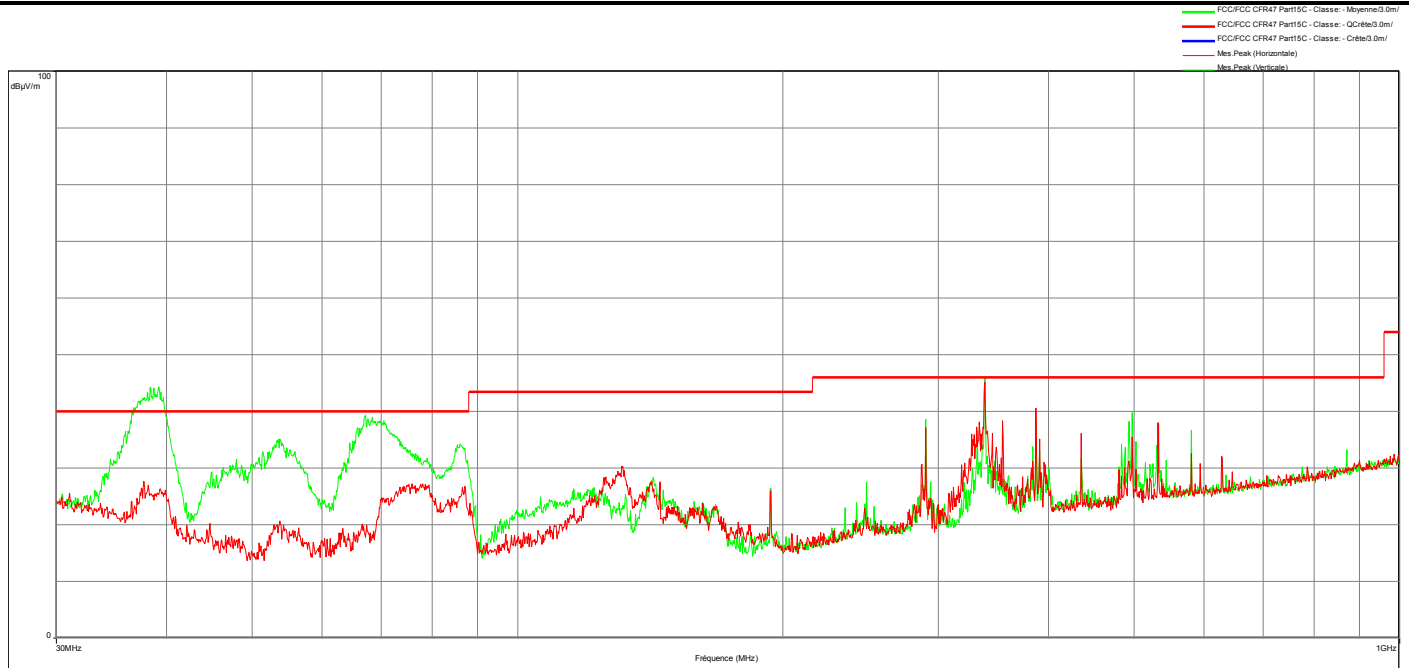
39.197	46.69	Vertical
54.242	48.88	Vertical
98.799	42.08	Vertical
117.346	37.12	Vertical
151.312	35.36	Vertical
198.827	27.02	Vertical
200.52	26.59	Vertical
250	33.18	Vertical
375.04	36.81	Vertical
425.04	37.1	Vertical
500.04	34.49	Vertical
525.04	36.34	Vertical
532.68	34.32	Vertical
548.28	36.57	Vertical
625	34.81	Vertical
875.04	35.25	Vertical



L C I E

RADIATED EMISSIONS

Graph name:	Emr#4	Test configuration:
Limit:	FCC CFR47 Part15C	(H+V) - Configuration 2 <1GHz
Class:		
Frequency range: [30MHz - 1GHz]		
Antenna polarization:	Horizontal & Vertical	RBW : 100kHz
Azimuth:	0° - 360°	VBW : 300kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Position
37.701	27.64	Horizontal
78.076	27.24	Horizontal
131.133	30.3	Horizontal
193.557	26.04	Horizontal
290.28	37.14	Horizontal
327.24	35.97	Horizontal
333.44	38.15	Horizontal
338.52	45.07	Horizontal
345.36	36.06	Horizontal
348.8	33.62	Horizontal
354.84	38.38	Horizontal
387.08	40.51	Horizontal

390.6	35.15	Horizontal
435.52	36.06	Horizontal
497.12	35.43	Horizontal
531.88	38.03	Horizontal
580.56	32.58	Horizontal
985.84	32.47	Horizontal
39.197	44.28	Vertical
53.545	35.1	Vertical
67.179	39.34	Vertical
124.775	26.58	Vertical
142.455	28.32	Vertical
193.557	26.47	Vertical
290.28	38.59	Vertical
331.88	36.59	Vertical

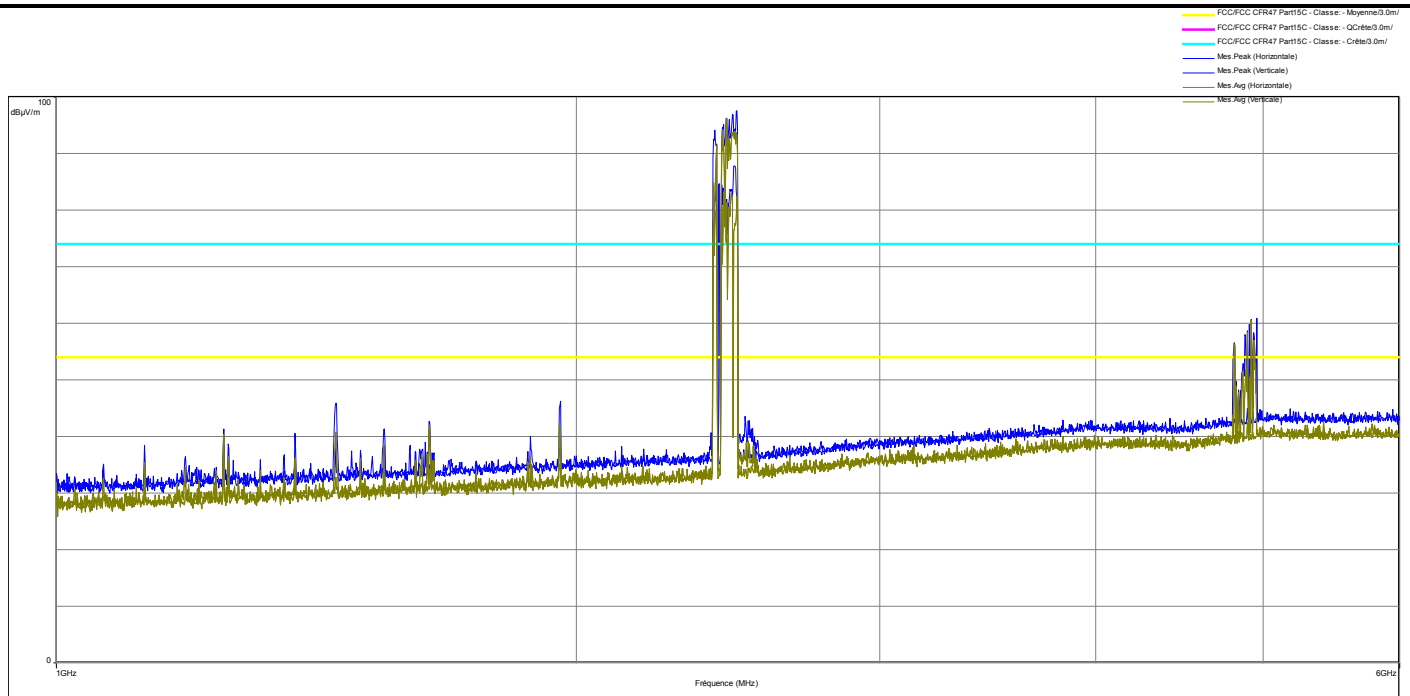
338.48	45.9	Vertical
383.52	33.76	Vertical
387.08	38.19	Vertical
390.68	33.1	Vertical
483.64	34.23	Vertical
488.72	33.63	Vertical
493.6	38.19	Vertical
497.32	39.83	Vertical
502.2	34.7	Vertical
530.6	33.96	Vertical
532.8	37.78	Vertical
580.64	36.65	Vertical
870.92	33.24	Vertical



L C I E

RADIATED EMISSIONS

Graph name:	Emr#5	Test configuration:
Limit:	FCC CFR47 Part15C	(H+V) - Configuration 1 >1GHz
Class:		
Frequency range: [1GHz - 6GHz]		
Antenna polarization:	Horizontal & Vertical	RBW : 1MHz
Azimuth:	0° - 360°	VBW : 3MHz



Spurious emissions



L C I E

Frequency (MHz)	Peak (dB μ V/m)	Polarization
1451.5	45.93	Horizontal
1644.5	42.62	Horizontal
2406.25*	94.13	Horizontal
2420*	84.62	Horizontal
2435.25*	95.07	Horizontal
2443.25*	96.21	Horizontal
2453.25*	96.03	Horizontal
2465.25*	96.91	Horizontal
2479.25*	97.6	Horizontal
4804*	53.63	Horizontal
4808.25*	55.13	Horizontal
4812.25*	56.51	Horizontal
4815.75*	56.22	Horizontal
4861.75*	51.12	Horizontal
4865.75*	51.58	Horizontal
4870*	52.87	Horizontal
4881.75*	57.95	Horizontal
4886*	52.59	Horizontal
4889.75*	52.16	Horizontal
4898.5*	58.61	Horizontal
4910*	59.8	Horizontal
4914.25*	51.44	Horizontal
4921.75*	60.71	Horizontal
4926*	56.18	Horizontal
4930*	54.2	Horizontal
4938.25*	58.35	Horizontal
4942*	57.19	Horizontal
4945.75*	54.83	Horizontal
4950.25*	53.79	Horizontal
4958.25*	60.91	Horizontal
1250.25	41.39	Vertical
1958.75	46.23	Vertical
2402.25*	79.28	Vertical
2410.25*	83.36	Vertical
2429.25*	84.4	Vertical
2435.5*	83.71	Vertical
2445.25*	81.9	Vertical
2455.25*	83.67	Vertical
2469.25*	87.81	Vertical
4837.75*	48.22	Vertical

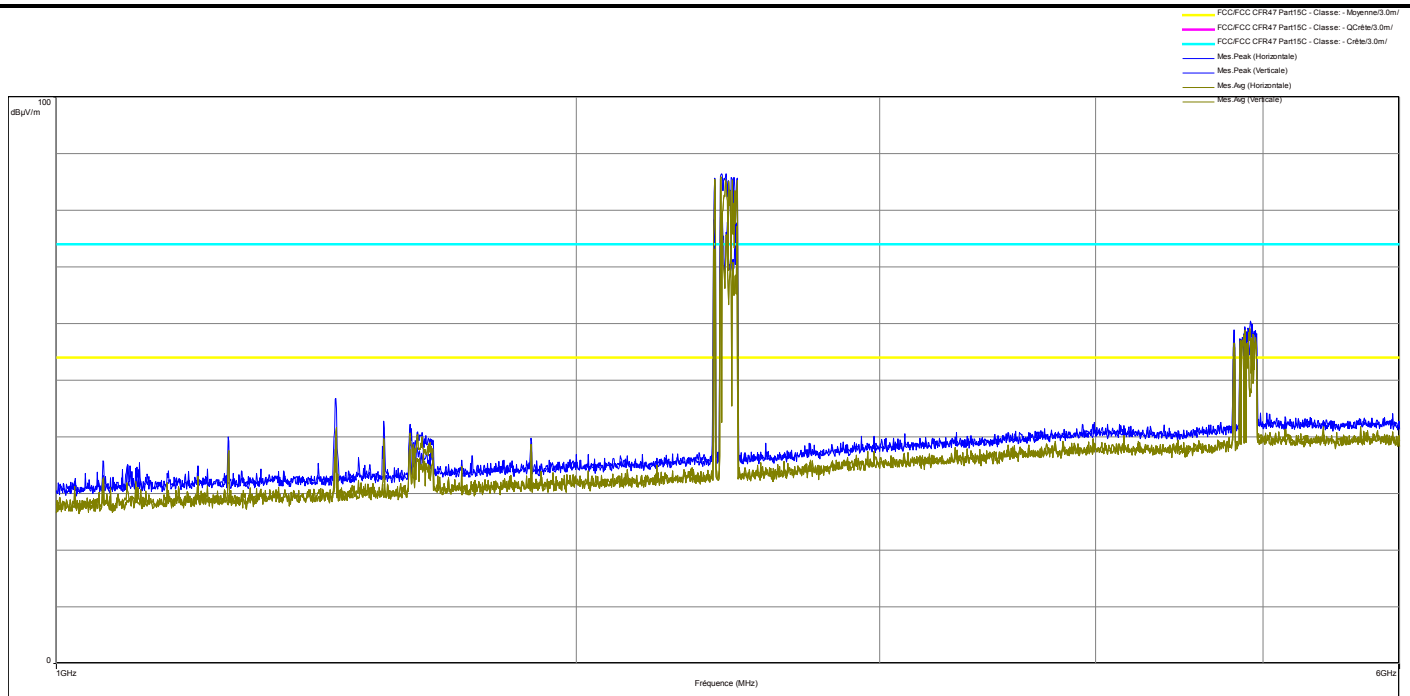
*Bluetooth frequencies (EUT)



L C I E

RADIATED EMISSIONS

Graph name:	Emr#6	Test configuration:
Limit:	FCC CFR47 Part15C	(H+V) - Configuration 2 >1GHz
Class:		
Frequency range: [1GHz - 6GHz]		
Antenna polarization:	Horizontal & Vertical	RBW : 1MHz
Azimuth:	0° - 360°	VBW : 3MHz



Spurious emissions



L C I E

Frequency (MHz)	Peak (dB μ V/m)	Polarization
1452	46.79	Horizontal
1547.75	42.76	Horizontal
1602.75	42.18	Horizontal
2405*	78.32	Horizontal
2430.25*	79.5	Horizontal
2444*	76.16	Horizontal
2448*	77.91	Horizontal
2460.25*	74.44	Horizontal
2472.25*	78.47	Horizontal
2476.25*	77.83	Horizontal
4805.75*	56.66	Horizontal
4810.25*	58.88	Horizontal
4814*	55.77	Horizontal
4848*	57.21	Horizontal
4852*	56.25	Horizontal
4855.75*	52.91	Horizontal
4860.25*	55.76	Horizontal
4864.75*	57.51	Horizontal
4868.25*	57.43	Horizontal
4872.25*	53.74	Horizontal
4876*	57.91	Horizontal
4880*	59.47	Horizontal
4884.25*	58.98	Horizontal
4892*	58.51	Horizontal
4896.25*	56.77	Horizontal
4900.25*	59.23	Horizontal
4904.25*	58.76	Horizontal
4908.25*	58.04	Horizontal
4912.25*	59.29	Horizontal
4916.5*	60.48	Horizontal
4920.5*	60.11	Horizontal
4924*	56.33	Horizontal
4928*	59.86	Horizontal
4932.25*	51.15	Horizontal
4936.25*	56.97	Horizontal
4940.5*	55.01	Horizontal
4944.25*	55.65	Horizontal
4948.5*	56.18	Horizontal
4952*	58.78	Horizontal
4956.25*	57.73	Horizontal

4960*	52.62	Horizontal
2407.25*	85.64	Vertical
2428.25*	86.45	Vertical
2444*	86.48	Vertical
2460*	85.8	Vertical
2470.25*	85.8	Vertical
2480.25*	85.64	Vertical
4806.25*	55.87	Vertical
4810*	56.78	Vertical
4814.5*	56.44	Vertical
4848.25*	57.34	Vertical
4852.5*	57.21	Vertical
4856*	57.11	Vertical
4860*	56.95	Vertical
4864.5*	57.28	Vertical
4868*	57.05	Vertical
4872.25*	57.69	Vertical
4876*	58.23	Vertical
4880.25*	53.94	Vertical
4884.25*	55.92	Vertical
4888*	56.76	Vertical
4892*	57.48	Vertical
4896.25*	56.05	Vertical
4900*	55.27	Vertical
4904*	56.17	Vertical
4908.5*	54.43	Vertical
4912.5*	55.44	Vertical
4916.25*	57.95	Vertical
4920*	58.68	Vertical
4923.75*	57.59	Vertical
4928.25*	57.54	Vertical
4932*	54.81	Vertical
4936*	58.35	Vertical
4940.5*	52.48	Vertical
4944.25*	58.66	Vertical
4948*	57.62	Vertical
4952*	54.12	Vertical
4956*	57.82	Vertical
4960.5*	58.23	Vertical

*Bluetooth frequencies (EUT)



9. UNCERTAINTIES CHART

<i>s</i> Type de mesure / <i>Kind of measurement</i>	Incertitude élargie laboratoire / <i>Wide uncertainty laboratory</i> (k=2) ± x	Incertitude limite du CISPR / <i>CISPR uncertainty limit</i> ± y
Mesure des perturbations conduites en tension sur le réseau d'énergie <i>Measurement of conducted disturbances in voltage on the power port</i>	3.57 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication <i>Measurement of conducted disturbances in voltage on the telecommunication port.</i>	3.28 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension <i>Measurement of discontinuous conducted disturbances in voltage</i>	3.47 dB	3.6 dB
Mesure des perturbations conduites en courant <i>Measurement of conducted disturbances in current</i>	2.90 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Moirans <i>Measurement of radiated electric field on the Moirans open area test site</i>	5.07 dB	5.2 dB

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / *The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limits values.*