



LCIE

LCIE  
Etablissement de Moirans  
ZI Centr'alp  
170, rue de Chatagnon  
38430 Moirans  
RCS Grenoble 408 363 174  
Tél. : +33 4 76 07 36 36  
Fax : +33 4 76 55 90 88

# TEST REPORT

N° 813247-R1-E

JDE : 132805

**Subject** : Essais de compatibilité électromagnétique conformément aux normes **FCC CFR 47 Part 15, Subpart B et C.**  
*Electromagnetic compatibility tests according to the standards FCC CFR 47 Part 15, Subpart B and C*

**ISSUED TO** : **ASTEEL FLASH DEVELOPPEMENT**  
Immeuble « Le Silène »  
43 chemin du Vieux Chêne  
38240 MEYLAN - FRANCE

**Matériel testé / Apparatus under test** :

- *Product* : **DETECTING AVALANCHE VICTIMS**
- *Trade mark* : **ASTEEL FLASH DEVELOPPEMENT**
- *Manufacturer* : **ASTEEL FLASH DEVELOPPEMENT**
- *Model* : **ARVA EVO4**
- *FCCID* : **O9BARVAADV4**
- *Serial number* : **EVO4-CEM**

*Test date* : From January 27<sup>th</sup> to 29<sup>th</sup>, 2015  
*Test location* : Moirans  
*Test performed by* : Jonathan PAUC  
*Composition of document* : 17 pages

*Modification of the last version* : None  
*Document issued on* : February 25<sup>th</sup>, 2015

**Written by :**  
**Jonathan PAUC**

**Tests operator**

**Approved by :**

**Anthony MERLIN**  
**Technical manager**



LABORATOIRE CENTRAL DES  
INDUSTRIES ELECTRIQUES  
LCIE SUD-EST  
ZI Centr'Alp  
170, Rue de Chatagnon  
38430 MOIRANS  
Tél. 04 76 07 36 36  
Fax 04 76 55 90 88

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

LCIE  
33, av du Général Leclerc  
BP 8  
92266 Fontenay-aux-Roses cedex  
France  
Tél : +33 1 40 95 60 60  
Fax : +33 1 40 95 86 56  
contact@lcie.fr  
www.lcie.fr  
Société par Actions Simplifiée  
au capital de 15 745 984 €  
RCS Nanterre B 408 363 174  
www.lcie.com



<b>SUMMARY</b>
----------------

1.	TEST PROGRAM .....	3
2.	SYSTEM TEST CONFIGURATION.....	4
3.	RADIATED EMISSION DATA .....	6
4.	ANNEX 1 (GRAPHS) .....	11
5.	UNCERTAINTIES CHART .....	17



**1. TEST PROGRAM**

**Standard:** - FCC Part 15, Subpart C  
 - ANSI C63.4 (2003)

EMISSION TEST	LIMITS			RESULTS (Comments)
	Frequency	Quasi-peak value (dBµV)	Average value (dBµV)	
Limits for conducted disturbance at mains ports 150kHz-30MHz	150- 500kHz	66 to 56	56 to 46	<b>NA</b>
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz	<b>Measure at 300m</b> 9kHz-490kHz : 67.6dBµV/m /F(kHz) <b>Measure at 30m</b> 490kHz-1.705MHz : 87.6dBµV/m /F(kHz) 1.705MHz-30MHz : 29.5 dBµV/m			<b>PASS</b>
Radiated emissions 30MHz-1GHz*	<b>Measure at 3m</b> 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m			<b>PASS</b>

\* The highest internal source of a testing device is defined like more the tenth harmonic of highest frequency generated or used in the testing device or on which the testing device works.

**2. SYSTEM TEST CONFIGURATION**

**2.1. JUSTIFICATION**

The system was configured for testing in a typical fashion (as a customer would normally use it).

**2.2. HARDWARE IDENTIFICATION**

ARVA EVO4

Sn: EVO4-CEM



Equipment Under Test

**Power supply:**

During all the tests, EUT is supplied by  $V_{nom}$ : 6VDC

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

Name	Type	Rating	Reference / Sn	Comments
Supply1	<input type="checkbox"/> AC <input type="checkbox"/> DC <input checked="" type="checkbox"/> Battery	6Vdc (4 x LR03 batteries "1.5Vdc")		/

**INPUTS/OUTPUTS - CABLE**

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
		None				

**AUXILIARY EQUIPMENT USED DURING TEST**

Type	Reference	Sn	Comments
			None



EQUIPMENT INFORMATION				
Frequency Carrier:	457 kHz			
RF mode:	<input checked="" type="checkbox"/> Transmitter	<input type="checkbox"/> Transceiver	<input checked="" type="checkbox"/> Receiver	<input type="checkbox"/> Standby
Antenna type:	<input type="checkbox"/> External:		<input checked="" type="checkbox"/> Internal:	
Antenna gain:	NC			
Equipment location	<input checked="" type="checkbox"/> Mobile station		<input type="checkbox"/> Fixed station	
Equipment designed for continuous operation: NO, emitted each 750ms during 100ms (Declaration of provider)				

### 2.3. EUT CONFIGURATION

A special configuration of the EUT permits:

- Permanent emission of the carrier frequency with modulation
- Permanent RX mode

Inboard test firmware version: v1.5

### 2.4. EQUIPMENT MODIFICATIONS

None

### 2.5. SPECIAL ACCESSORIES

None

### 3. RADIATED EMISSION DATA

#### 3.1. CLIMATIC CONDITIONS

Date of test	January 27 <sup>th</sup> , 2014
Test performed by	J.PAUC
Atmospheric pressure	1005hPa
Relative humidity	36%
Ambient temperature	22°C

#### 3.2. TEST SETUP

The installation of EUT is identical for pre-characterization measurement in a 3 meters semi anechoic chamber and for measures on a 10 meters Open site.



Pre-characterisation Measurement





*Radiated emission test setup*

**3.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

None



**3.1. TEST EQUIPMENT**

<b>OATS (CHARACTERISATION MEASUREMENT)</b>				
<b>DESCRIPTION</b>	<b>MANUFACTURER</b>	<b>MODEL</b>	<b>N° LCIE</b>	<b>Due Date</b>
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	10/15
Cable	SUCOFLEX	106G	A5329061	02/15
Cable (OATS)	-	-	A5329623	10/15
Radiated emission comb generator	BARDET	-	A3169050	-
OATS	-	-	F2000409	09/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	01/15*
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/15
Antenna mast (OATS)	LCIE	-	F2000288	-
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372	-
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392	-
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403	-
Table	MATURO Gmbh	-	F2000437	-

<b>ANECHOIC CHAMBER (PRE-CHARACTERISATION MEASUREMENT)</b>				
<b>DESCRIPTION</b>	<b>MANUFACTURER</b>	<b>MODEL</b>	<b>N° LCIE</b>	<b>Due Date</b>
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	10/15
Antenna Bi-Log XWing	TESEQ	CBL6144	C2040146	11/16
Emission Cable	MICRO-COAX	6GHz	A5329654	04/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	01/15*
Emission Cable	MICRO-COAX	6GHz	A5329655	04/15
Emission Cable	MICRO-COAX	6GHz	A5329656	04/15
Semi-Anechoic chamber #2	SIEPEL	-	D3044015	04/15
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/15
Thermo-hygrometer (C2)	LACROSS Techn.	WS-2357	B4206015	08/15
Turntable controller (Cage#2)	ETS Lingren	Model 2066	F2000393	-
Turntable chamber (Cage#2)	ETS Lingren	Model 2165	F2000404	-
Table	LCIE	-	F2000438	-

\*: 1 year & 2 month +(Derogation of 3 month)





### 3.2. TEST SEQUENCE AND RESULTS

#### 3.2.1. Pre-characterization at 3 meters [9kHz-30MHz]

A pre-scan of all the setup has been performed in a 3 meters semi anechoic chamber. The distance between EUT and antenna is 3 meters. For Pre-characterization, the loop antenna was rotated during the test for maximized the emission measurement. Measurement performed on 3 axis of EUT. Frequency band investigated is 9kHz to 30MHz.

The pre-characterization graphs are obtained in PEAK detection.

See graph for 9kHz-30MHz band:

Axis XY (worst case)	Antenna 0°	<b>Emr#1</b>	(See annex 1)
Axis Z (worst case)	Antenna 0°	<b>Emr#2</b>	(See annex 1)

#### 3.2.2. Pre-characterization [30MHz-1GHz]

For frequency band 30MHz to 1GHz, a pre-scan of all the setup has been performed in a 3 meters semi anechoic chamber.

The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization with a log-periodic antenna. The EUT is being rotated on 360° and on 3 axis during the measurement. The pre-characterization graphs are obtained in PEAK detection.

See graphs for 30MHz-1GHz:

H polarization	Axis XY	<b>Emr#3</b>	(See annex 1)
V polarization	Axis XY	<b>Emr#4</b>	(See annex 1)
H polarization	Axis Z	<b>Emr#5</b>	(See annex 1)
V polarization	Axis Z	<b>Emr#6</b>	(See annex 1)

#### 3.2.3. Characterization on 10 meters open site below 30 MHz

The product has been tested according to ANSI C63.4 (2003), FCC part 15 subpart C. Radiated Emissions were measured on an open area test site. A description of the facility is on file with the FCC.

The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart C §15.109 limits and C §15.209.

Antenna height was 1m for both horizontal and vertical polarization.

Antenna was rotated around its vertical axis.

Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown in following tables.

Frequency (MHz)	QPeak Limit (dBµV/m) @ 10m	Qpeak (dBµV/m)	Qpeak-Limit (Margin dB)	Turntable Angle (deg)	Ant. Pol./ Angle (deg)	Tot Corr (dB)
0.457	73.5	55.8	-17.7	0	90	44.9

\*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)  
(M@300m = M@10m-59.1dB)



### 3.2.4. Characterization on 10 meters open site from 30MHz to 1GHz

The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 120kHz from 30 MHz to 1GHz. Antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on clause 3.2

#### Worst case final data result:

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
No frequency observed, margin >20dB in pre-characterization									

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

### 3.3. 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.

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

The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

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

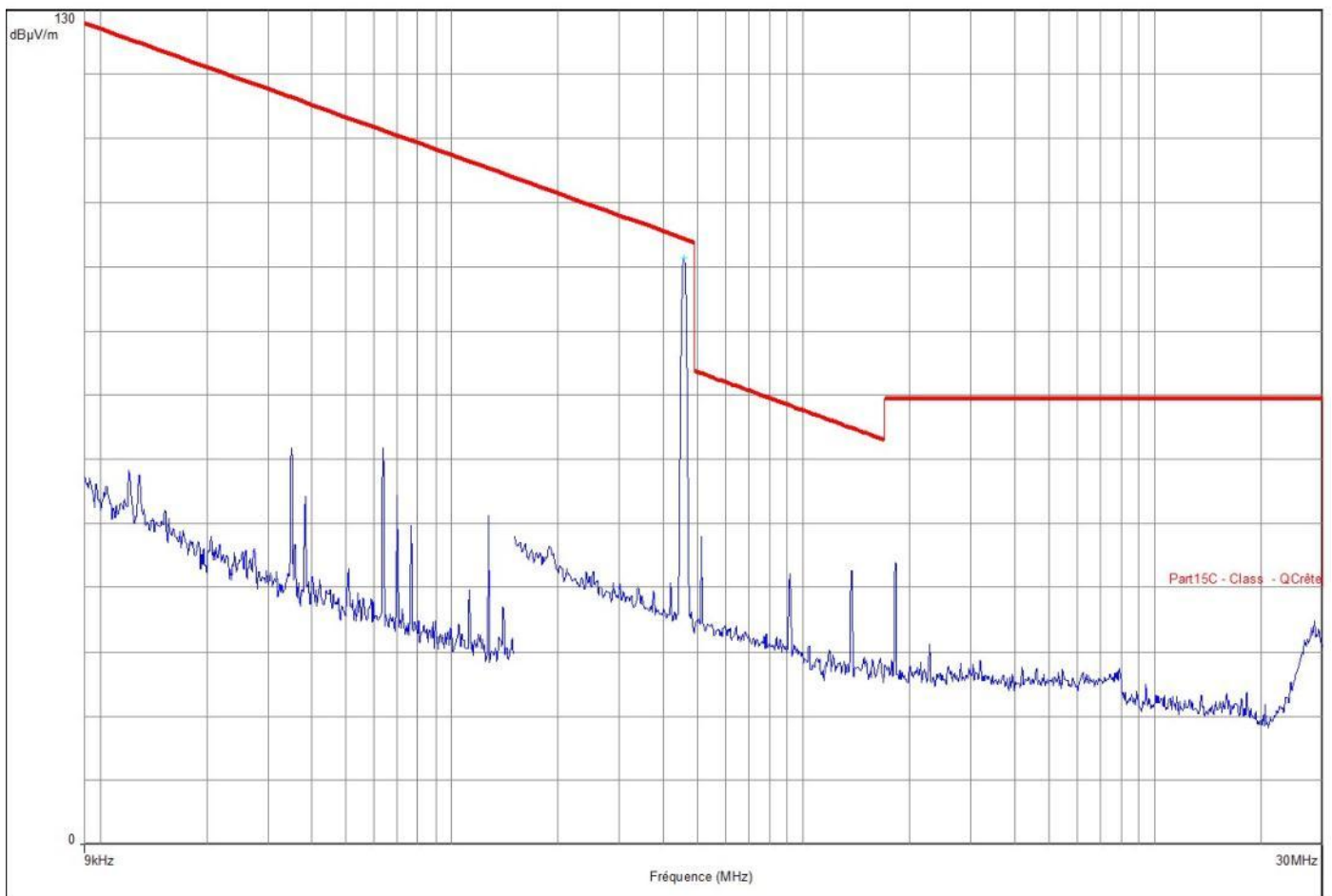


**4. ANNEX 1 (GRAPHS)**

**RADIATED EMISSIONS**

<b>Graph name:</b>	Emr#1	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part15C	Emr1 - TX P0 Pos XY
<b>Class:</b>		
<b>Frequency range: [9kHz - 30MHz]</b>		
<b>Antenna polarization:</b>	0°	<b>RBW :</b> 200Hz/10kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 1kHz / 30kHz

— FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/  
+ Niveau (Finaux Manuel) (Verticale)  
— Mes.Peak (Verticale)



Frequency (MHz)	Peak Level (dBµV/m)
0.457105	91.38

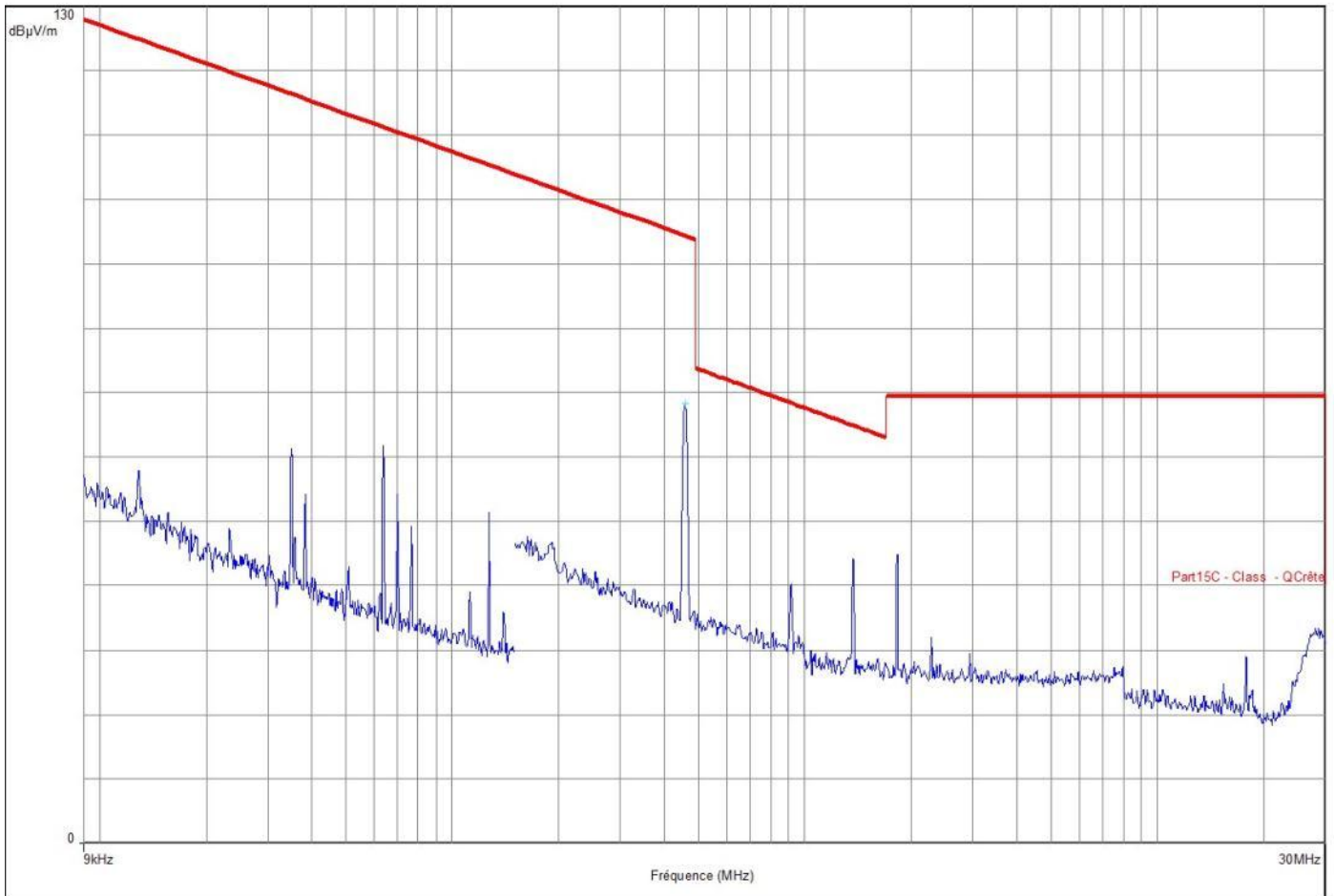


L C I E

**RADIATED EMISSIONS**

<b>Graph name:</b>	Emr#2	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part15C	Emr2 - TX P0 Pos Z
<b>Class:</b>		
<b>Frequency range: [9kHz - 30MHz]</b>		
<b>Antenna polarization:</b>	0°	<b>RBW :</b> 200Hz/10kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 1k/30kHz

— FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/  
+ Niveau (Finaux Manuel) (Verticale)  
— Mes.Peak (Verticale)



Frequency (MHz)	Peak Level (dBµV/m)
0.45719	68.19

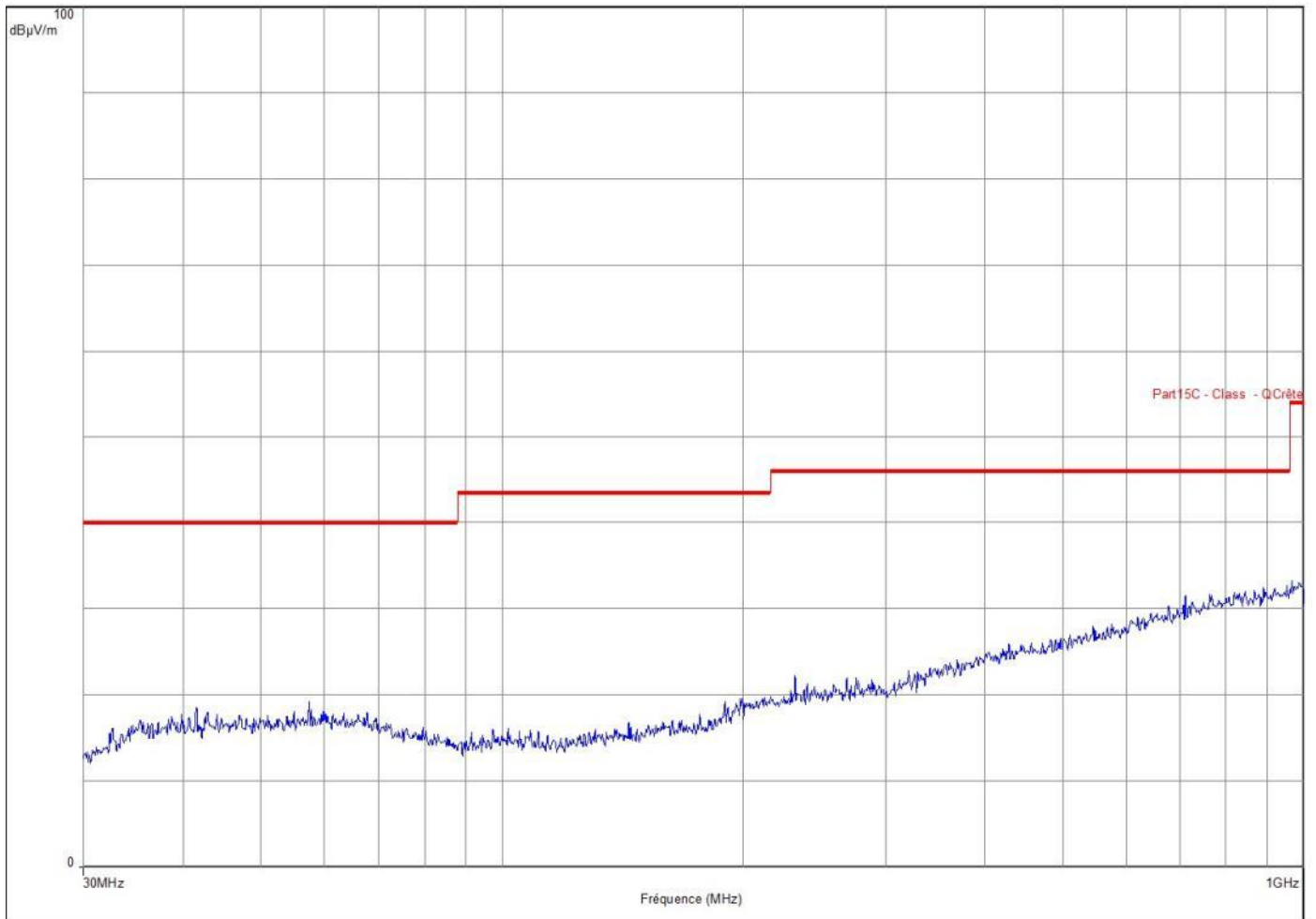


L C I E

**RADIATED EMISSIONS**

<b>Graph name:</b>	Emr#3	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part15C	Emr3 - TX PH Pos XY
<b>Class:</b>		
<b>Frequency range: [30MHz - 1GHz]</b>		
<b>Antenna polarization:</b>	horizontal	<b>RBW :</b> 100kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 300kHz

— FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/  
— Mes.Peak (Horizontale)



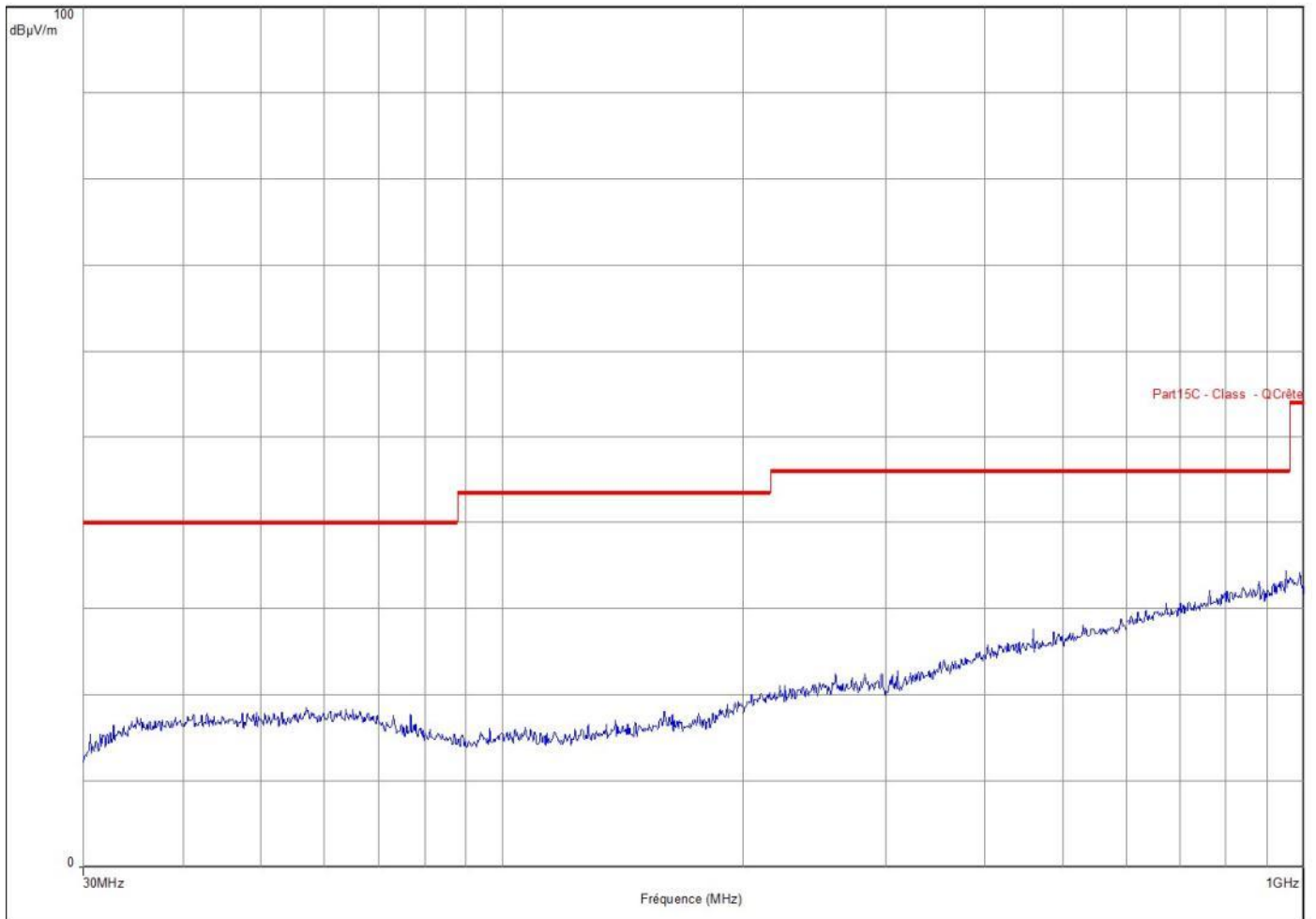


L C I E

**RADIATED EMISSIONS**

<b>Graph name:</b>	Emr#4	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part15C	Emr4 - TX PV Pos XY
<b>Class:</b>		
<b>Frequency range: [30MHz - 1GHz]</b>		
<b>Antenna polarization:</b>	Vertical	<b>RBW :</b> 100kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 300kHz

— FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/  
— Mes.Peak (Verticale)





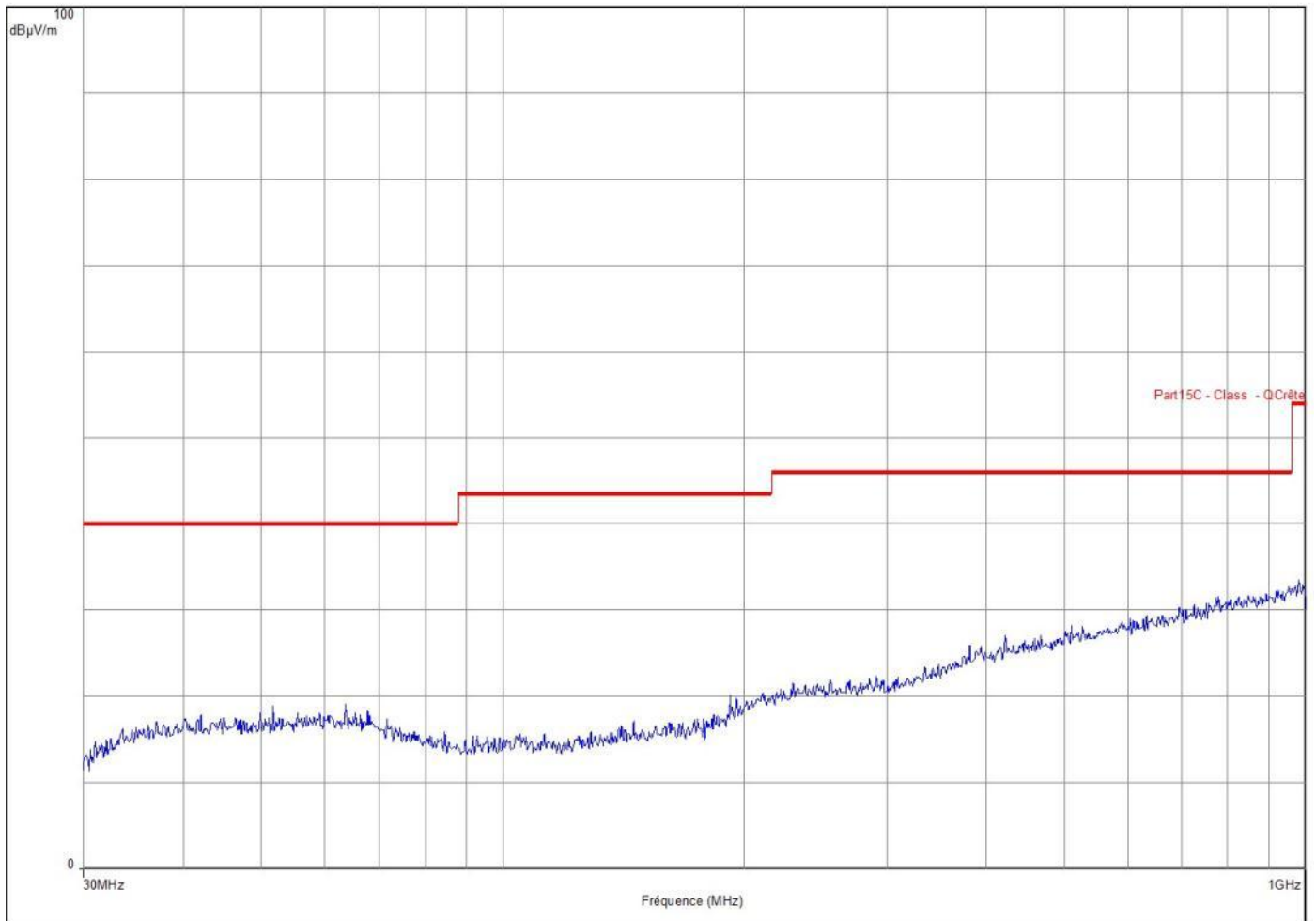


L C I E

**RADIATED EMISSIONS**

<b>Graph name:</b>	Emr#5	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part15C	Emr5 - TX PH Pos Z
<b>Class:</b>		
<b>Frequency range: [30MHz - 1GHz]</b>		
<b>Antenna polarization:</b>	horizontal	<b>RBW :</b> 100kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 300kHz

— FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/  
— Mes.Peak (Horizontale)



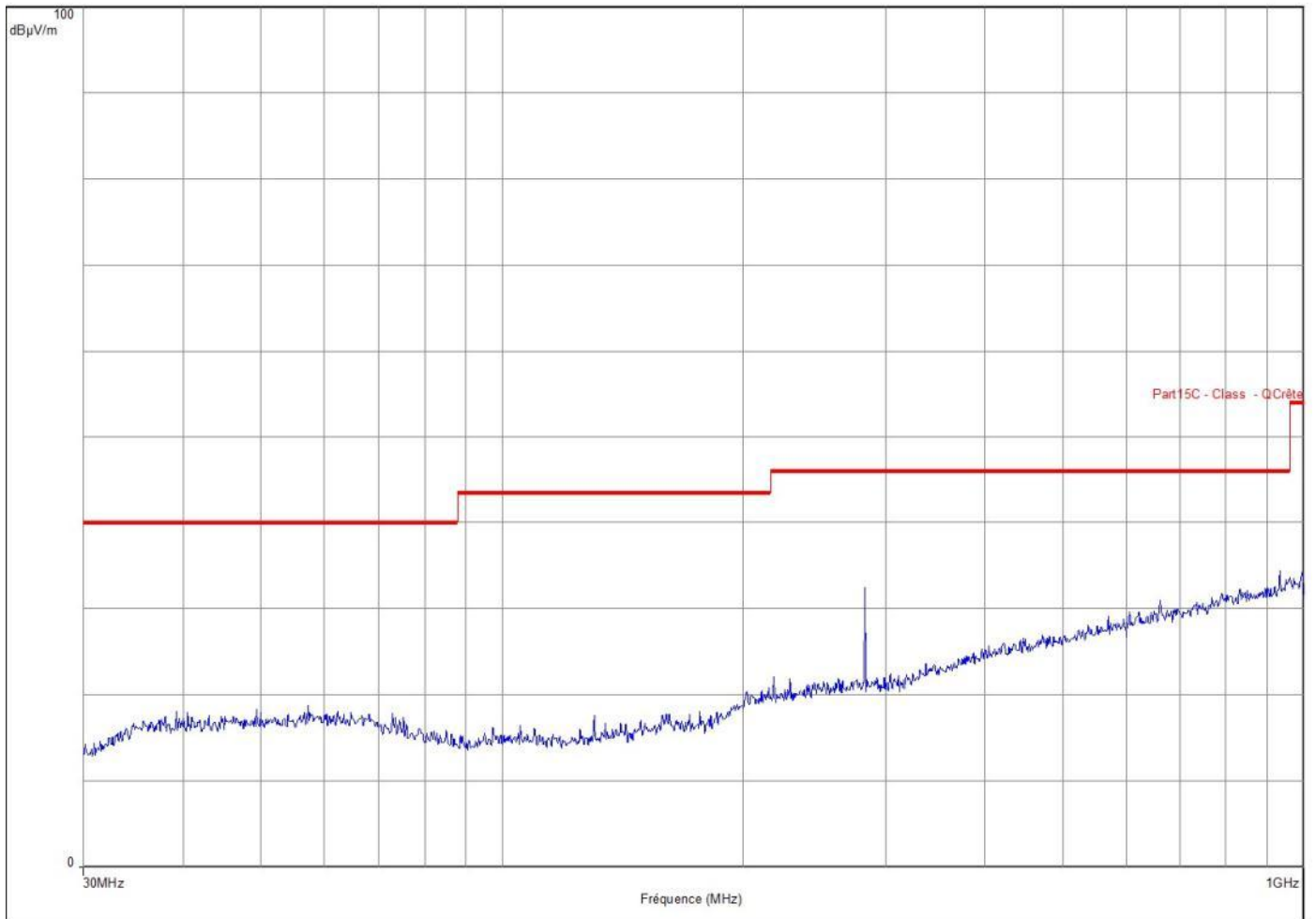


L C I E

**RADIATED EMISSIONS**

<b>Graph name:</b>	Emr#6	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part15C	Emr6 - TX PV Pos Z
<b>Class:</b>		
<b>Frequency range: [30MHz - 1GHz]</b>		
<b>Antenna polarization:</b>	Vertical	<b>RBW :</b> 100kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 300kHz

— FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/  
— Mes.Peak (Verticale)





**5. 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 <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.