



L C I E

Rapport d'essai / Test report

N° 669342-R1-E

JDE : 122347

DELIVRE A / ISSUED TO

: **ASTEEL FLASH DEVELOPPEMENT**

Immeuble « Le Silène »
43 chemin du Vieux Chêne
38240 MEYLAN - FRANCE

Objet / 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*

Matériel testé / Apparatus under test :

- Produit / Product : **DETECTING AVALANCHE VICTIMS**
- Marque / Trade mark : **ASTEEL FLASH DEVELOPPEMENT**
- Constructeur / Manufacturer : **ASTEEL FLASH DEVELOPPEMENT**
- Type / Model : **ARVA NEO**
- N° de série / serial number : **7**

Date des essais / Test date

: Le 1er Aout 2013 / August 1st, 2013

Lieu d'essai / Test location

: **LCIE SUD-EST**
ZI Centr'Alp – 170 rue de Chatagnon
38430 MOIRANS - FRANCE

Test réalisé par / Test performed by

: Anthony MERLIN

Ce document comporte / Composition of document : 16 pages.

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Anthony MERLIN

MOIRANS, LE 12 SEPTEMBRE 2013 / SEPTEMBER 12th, 2013

Approuvé par / Approved by
Jacques LORZAN



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1. TEST PROGRAM

Standard:

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

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance at mains ports 150kHz-30MHz	Frequency	Quasi-peak value (dBμV)	Average value (dBμV)	Not Applicable
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz	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
Radiated emissions 30MHz-1GHz*	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

* 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

Equipment under test (EUT):

ARVA NEO

Serial number: 7

Power supply:

- Battery: 3 x LR03, 1.5V x 3 batteries.
- During all the tests, EUT is supplied by 3 new batteries.

Input/output:

- None

Auxiliaries used for testing:

- None

I/O cables used for testing:

- None

Equipment information – 457kHz:

- External antenna connector: NO
- Radiated fundamental frequency band: 457kHz
- Antenna type: Integral
- Number of channel: 1 @ 457kHz
- Equipment designed for continuous operation: NO, emitted each 750ms during 100ms (Declaration of provider)

2.3. EUT CONFIGURATION

Equipment under test can set with following parameters:

- @457kHz
- Transmission like usually

2.4. EQUIPMENT MODIFICATIONS

None

2.5. SPECIAL ACCESSORIES

None

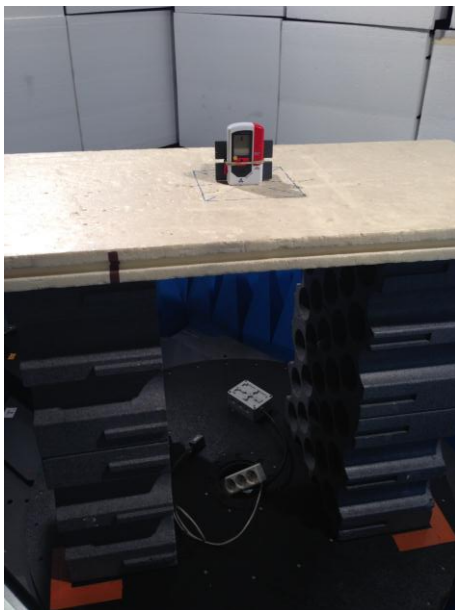
3. RADIATED EMISSION DATA

3.1. CLIMATIC CONDITIONS

Date of test : August 1st, 2013
Test performed by : A.MERLIN
Atmospheric pressure : 9899hPa
Relative humidity : 49%
Ambient temperature : 25°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.





Radiated emission test setup

3.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None



3.1. TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447F	A7486006
Antenna Bi-log	CHASE	CBL6111A	C2040051
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052
Antenna Bi-log	CHASE	CBL6111A	C2040172
Cable N/N	-	-	A5329038
Cable	SUCOFLEX	106G	A5329061
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329188
Cable	UTIFLEX	-	A5329192
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329199
Cable N/N	-	-	A5329206
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Radiated emission comb generator	BARDET	-	A3169050
OATS	-	-	F2000409
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403
Table	MATURO GmbH	-	F2000437
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444

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 Z (worst case) – Antenna 0°

Axis Z (worst case) – Antenna 90°

Emr#1

(See annex 1)

Emr#2

(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	Emr#3	(See annex 1)
V polarization	Axis XY	Emr#4	(See annex 1)
H polarization	Axis Z	Emr#5	(See annex 1)
V polarization	Axis Z	Emr#6	(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	45.4	-28.1	225	90	45.1

*: 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 52.5dB 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.

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



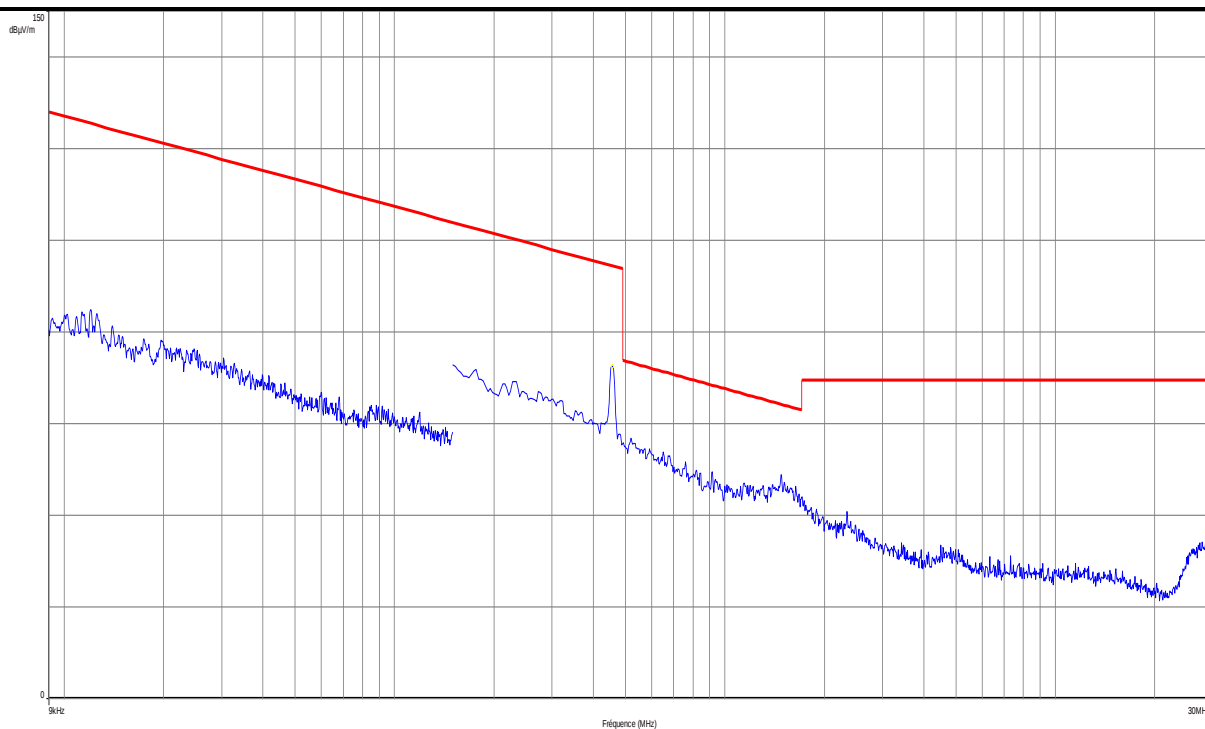
4. ANNEX 1 (GRAPHS)

RADIATED EMISSIONS

Graph name :	Emr#1	Test configuration:
Limit :	FCC PART15	AXIS Z - 0°
Class :	B	

PARAMETERS

Antenna polarization:	Horizontal	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	100kHz	QPeak Limit@3m
VBW :	300kHz	
Frequency :	9kHz - 30MHz	



Frequency (MHz)	Peak (dBμV/m)
0.457*	72.66

*Carrier Frequency

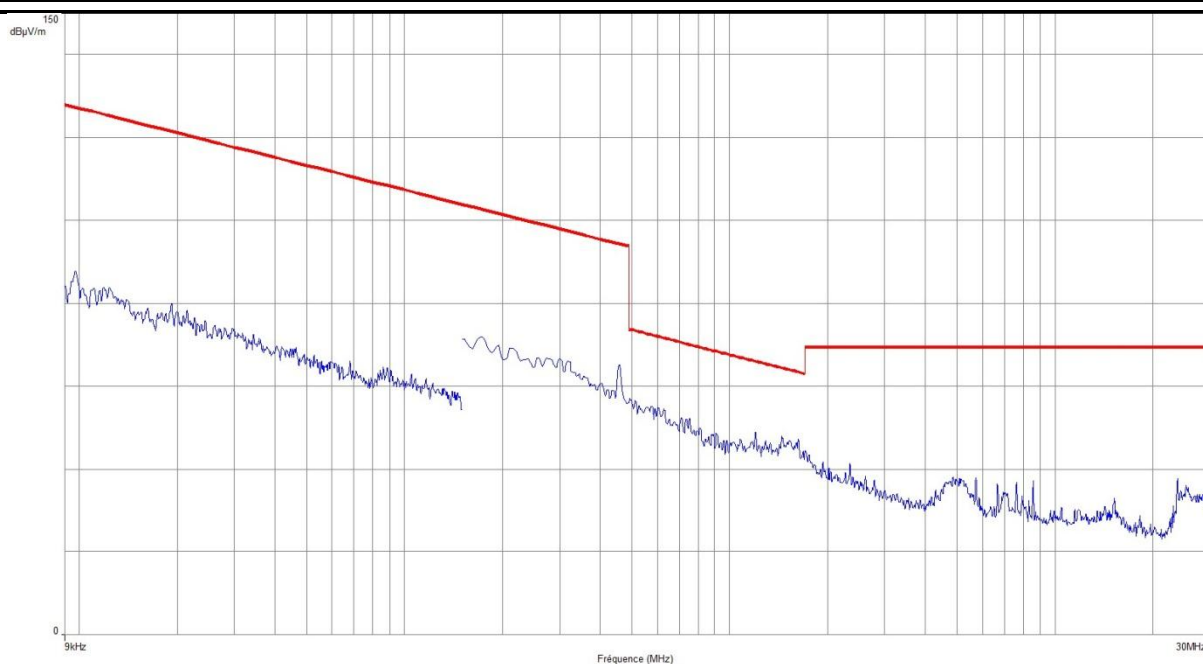


RADIATED EMISSIONS

Graph name :	Emr#2	Test configuration:
Limit :	FCC PART15	AXIS Z - 90° (C)
Class :	B	

PARAMETERS

Antenna polarization:	Horizontal	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	100kHz	
VBW :	300kHz	QPeak Limit@3m
Frequency :	9kHz - 30MHz	

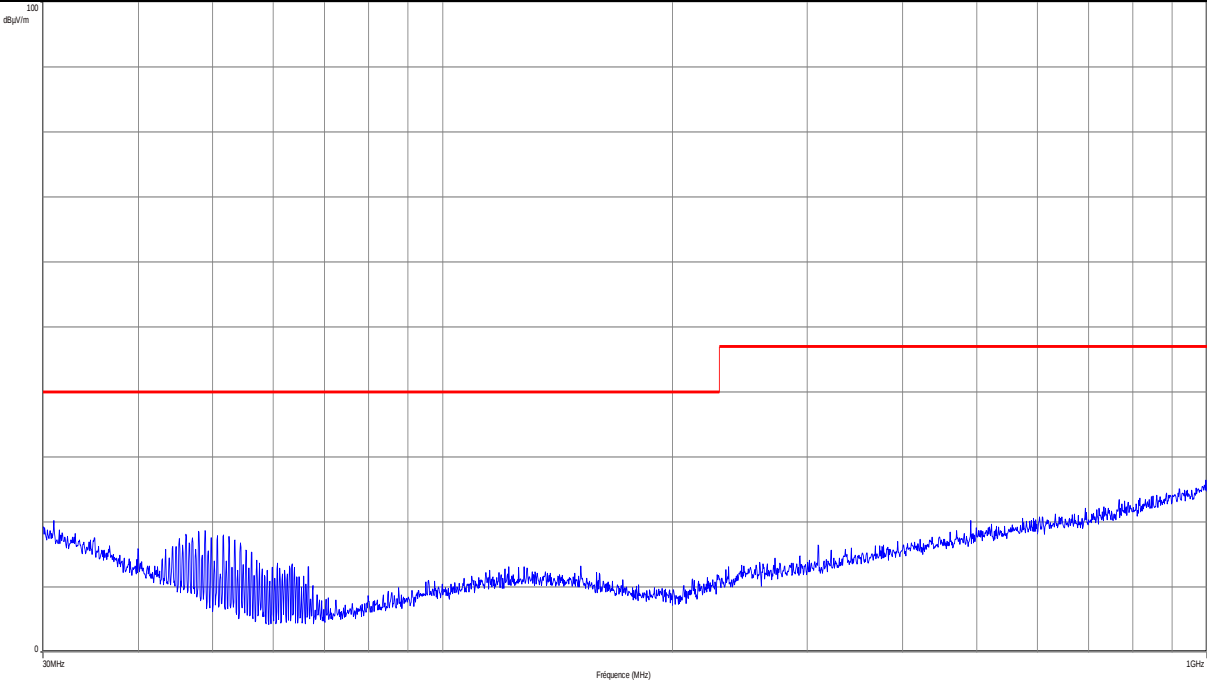


Frequency (MHz)	Peak (dBμV/m)
0.457*	68.5

*Carrier Frequency



RADIATED EMISSIONS		
Graph name :	Emr#3	Test configuration:
Limit :	FCC PART15	Axis XY - Pol H
Class :	B	
PARAMETERS		
Antenna polarization:	Horizontal	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	100kHz	
VBW :	300kHz	QPeak Limit@3m
Frequency :	30MHz - 1GHz	



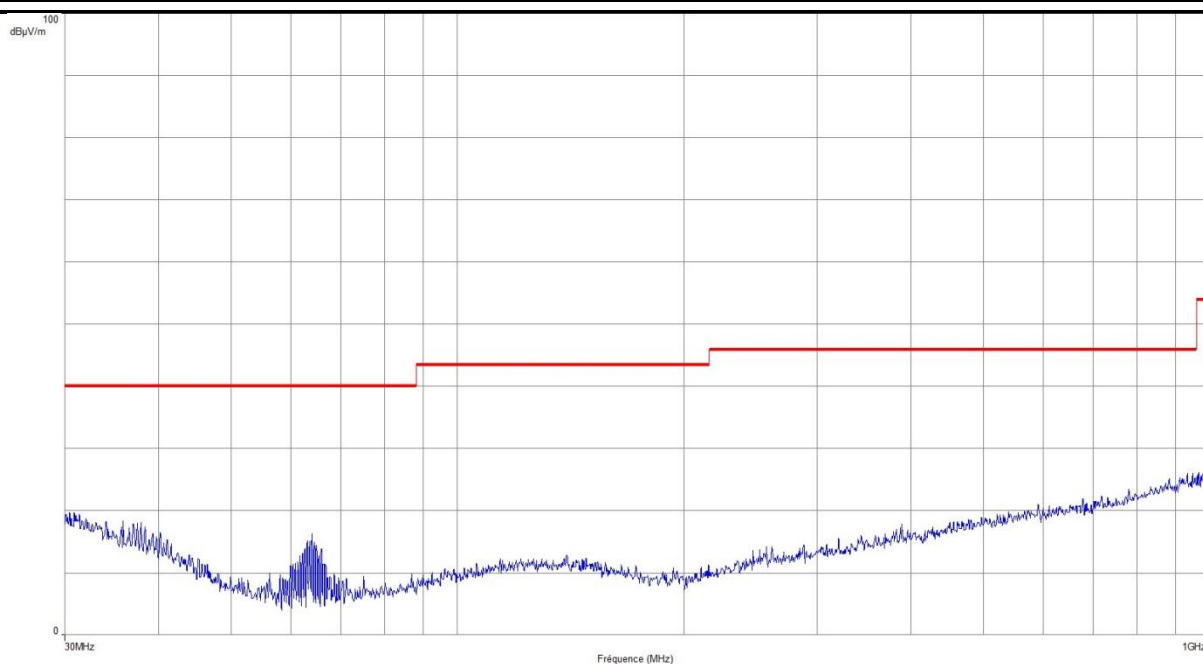


RADIATED EMISSIONS

Graph name :	Emr#4	Test configuration:
Limit :	FCC Part15C	Axis XY - Pol V
Class :		

PARAMETERS

Antenna polarization:	Vertical	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	100kHz	
VBW :	300kHz	QPeak Limit@3m
Frequency :	30MHz - 1GHz	

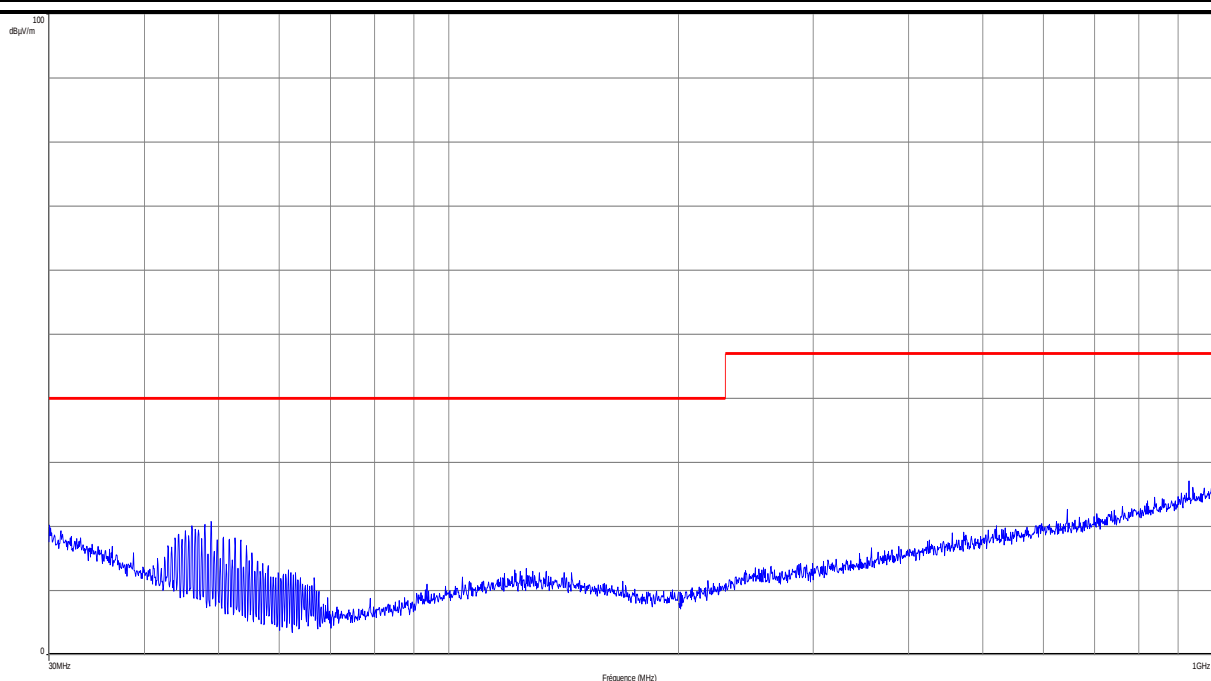


**RADIATED EMISSIONS**

Graph name :	Emr#5	Test configuration:
Limit :	FCC PART15	Axis Z - Pol H
Class :	B	

PARAMETERS

Antenna polarization:	Horizontal	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	100kHz	
VBW :	300kHz	QPeak Limit@3m
Frequency :	30MHz - 1GHz	



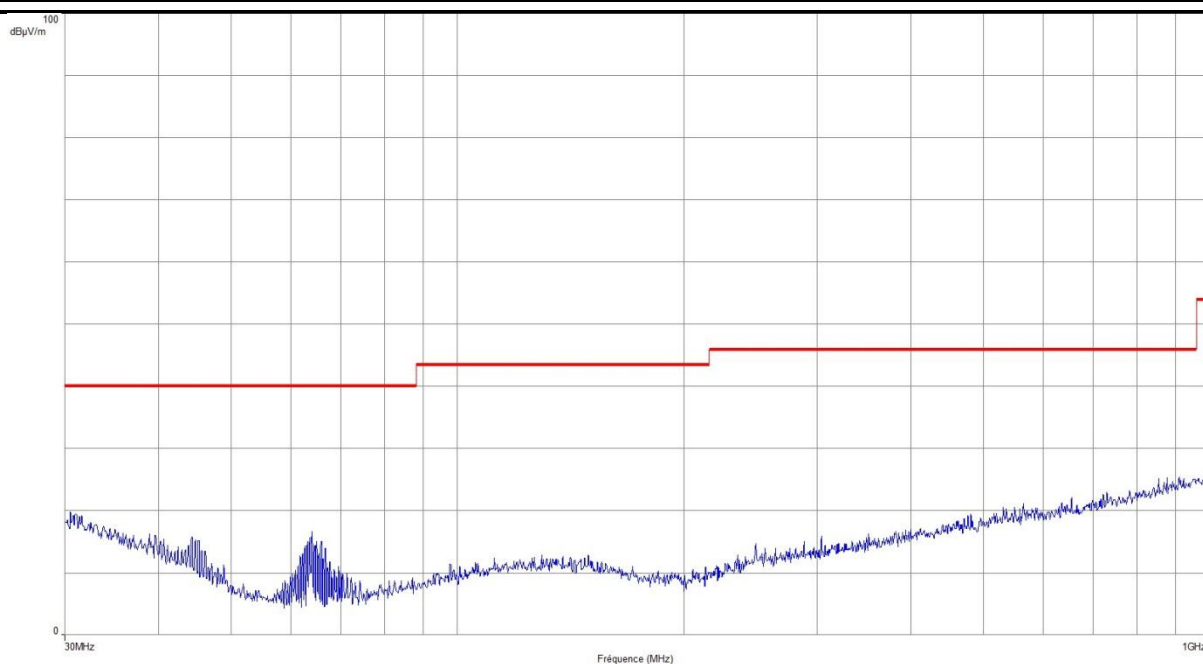


RADIATED EMISSIONS

Graph name :	Emr#6	Test configuration:
Limit :	FCC Part15C	Axis Z - Pol V
Class :		

PARAMETERS

Antenna polarization:	Vertical	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	100kHz	
VBW :	300kHz	QPeak Limit@3m
Frequency :	30MHz - 1GHz	



**5. UNCERTAINTIES CHART**

Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) $\pm x$	Incertitude limite du CISPR / CISPR uncertainty limit $\pm y$
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.