TEST REPORT

N°: 171326-762045-A (FILE#1045110) **Version : 03**

Subject	**Electromagnetic compatibility tests according to the standards:** **FCC CFR 47 Part 15, Subpart B.** **ANSI C63.4 (2014)** **ICES-003 (2020)**
Issued to	**SYCLOPE ELECTRONIQUE** Rue du Bruscos 64230 - SAUVAGNON France
Apparatus under test	
↳ Product	Electrode free chlorine sensor
↳ Trade mark	**SYCLOPE**
↳ Manufacturer	**SYCLOPE**
↳ Family range	**Type CAA320X Co/Gold version and Type CAA330X Co/Platinum version**
↳ Model under test	**CAA3206**
↳ Serial number	**204500534**
↳ FCCID	**2AS3B-PROBE-CUPT**
Conclusion	See Test Program chapter
Test date	February 8, 2021
Test location	MOIRANS
FCC Test site	FR0008 - 197516
IC Test site	FR0008 – 6500A
Sample receipt date	February 5, 2021
Composition of document	15 pages
Document issued on	April 4, 2022

Written by :
Majid MOURZAGH
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

PUBLICATION HISTORY

Version	Date	Author	Modification
01	February 19, 2021	Majid MOURZAGH	Creation of the document
02	March 28, 2022	Majid MOURZAGH	Adding FCC ID on page 1
03	April 4, 2022	Majid MOURZAGH	Add pictures on test setup RADIATED EMISSION

Each new edition of this test report replaces and cancels the previous edition. The control of the old editions of report is under responsibility of client.

SUMMARY

1. TEST PROGRAM

1.1. FCC PART15B / ICES-003

Standard:

- ✓ **FCC Part 15, Subpart B (Digital Devices)**
- ✓ **ANSI C63.4 (2014)**
- ✓ **ICES-003 (2020)**

1.1.1. Requirements for disturbance emissions – Class B

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance 150kHz-30MHz **FCC §15.107**	**Access: AC power**			**NA**
	Frequency	**Quasi-peak**	**Average**	
	150-500kHz	66 to 56 dBµV	56 to 46 dBµV	
	0.5-5MHz	56 dBµV	46 dBµV	
	5-30MHz	60 dBµV	50 dBµV	
Radiated emissions 30MHz-1GHz **FCC §15.109**	**Access: Enclosure port of ancillary equipment**			**PASS**
	Frequency	**Quasi-peak @10m**		
	30MHz-88MHz	40.0 dBµV/m		
	88MHz-216MHz	43.5 dBµV/m		
	216MHz-960MHz	46.0 dBµV/m		
	Above 960MHz	54.0 dBµV/m		
Radiated emissions 1GHz- *Highest Frequency*GHz* **FCC §15.109**	**Access: Enclosure port of ancillary equipment**			**NA**
	Frequency	**Peak @3m**	**Average @3m**	
	1- *Highest Frequency*GHz	74.0 dBµV/m	54.0 dBµV/m	

NA: Not Applicable / NP: Not Performed, not requested by the customer (It cannot be taken into account for the declaration of conformity)
[D]: Divergence, the last version is used to make it possible to test the product with the standard which describes the current state of the art and thus to answer as well as possible his environment of final use.
***§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.
Special condition for intentional radiator:

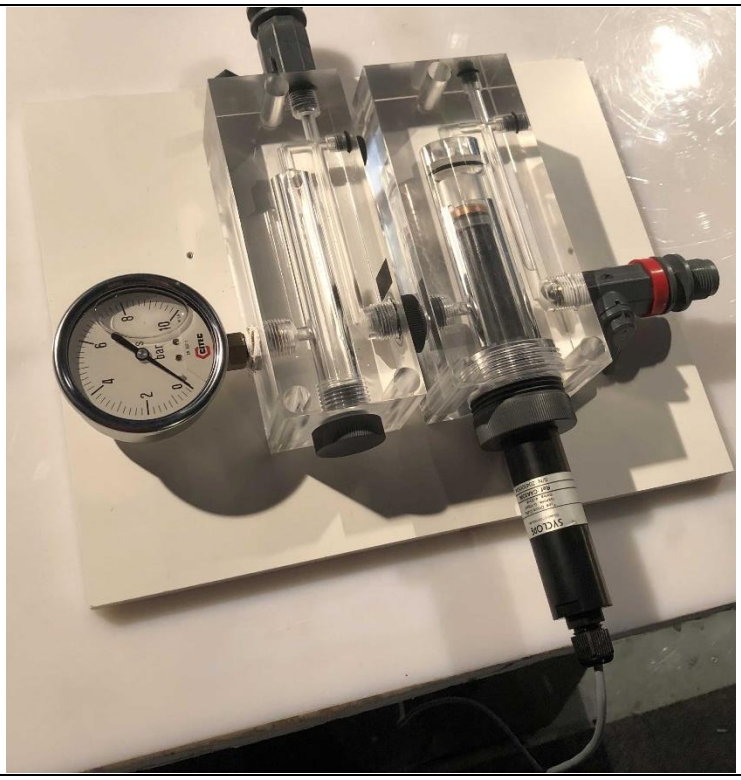
- For a composite system comprised of a digital device using a clock frequency of 1 GHz as the highest frequency for the digital logic and an intentional radiator operating at 2.4 GHz, the composite is required to be investigated to the upper frequency of 24 GHz (in this case, 10 times the intentional radiator frequency is the higher frequency).

- For a composite system comprised of a digital device using a clock frequency of 2 GHz as the highest frequency for the digital logic and an intentional radiator operating at 913 MHz, the composite is required to be investigated to the upper frequency of 10 GHz (in this case, 5 times the unintentional radiator clock frequency is the higher frequency).

2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
CAA3206 **Serial Number: 204500534**



Equipment Under Test

Power supply:
During all the tests, EUT is supplied by V_{nom}: **12VDC**
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply	☐ AC ☑ DC ☐ Battery	10-25VDC 25mA	/	/

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply	2 wires	9	☐	☐	☑	Supply1 and Access1 are the same cable
Access1	4-20mA output	9	☐	☐	☑	Supply1 and Access1 are the same cable

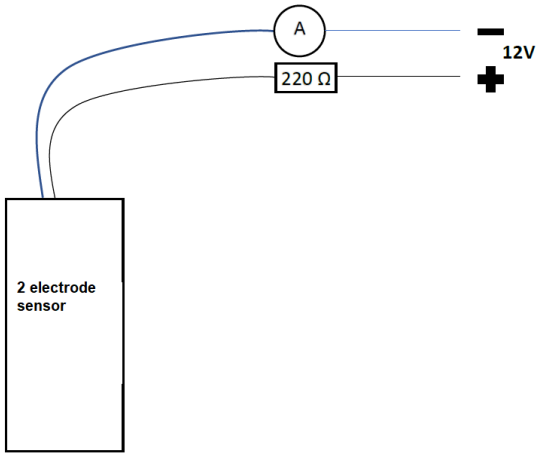
Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Multimeter	FLUKE 289	/	/
DC power supply	METRIX AX503	/	/

2.2. EUT CONFIGURATION – RUNNING MODE

Hardware information			
Highest internal frequency (PLL, Quartz, Clock, Microprocessor…):	**$F_{Highest}$:**	**NC <108MHz**	**MHz**
Firmware (if applicable):	**V. :**	**N/A**	
Software (if applicable):	**V. :**	**N/A**	

***Configuration n°1*:**
Setup:



Resistor simulates chlorinated water and allows mesure value on 4-20mA output.

Control: Mesure of 4-20mA ouput by amperemeter.

2.3. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

2.4. SPECIAL ACCESSORIES

None

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 is added. The amplifier gain of 29dB is subtracted, giving 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.

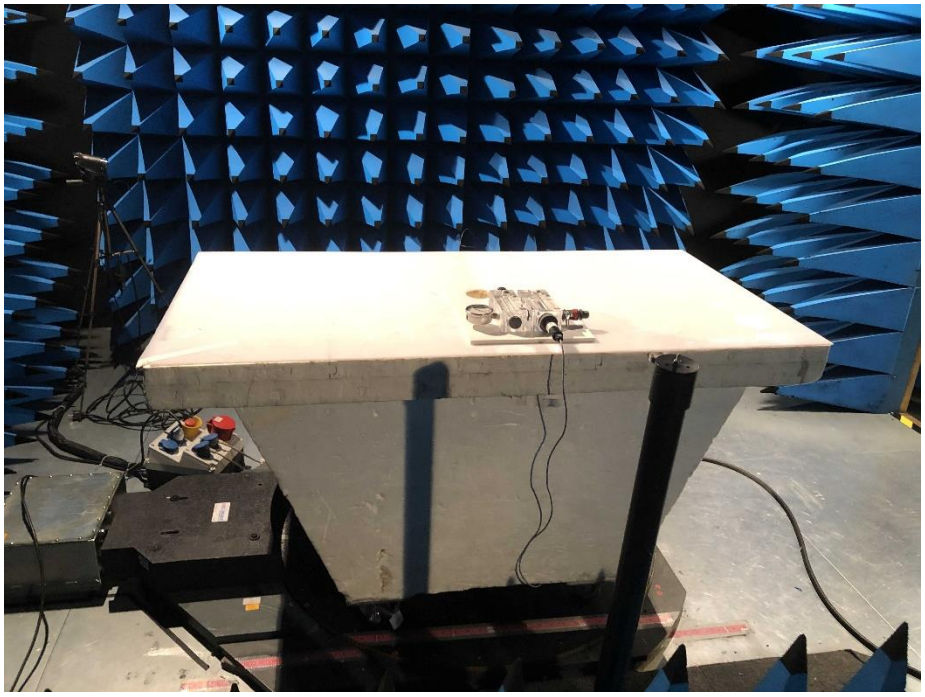
3. MEASUREMENT OF RADIATED EMISSION (30MHZ-1GHZ)

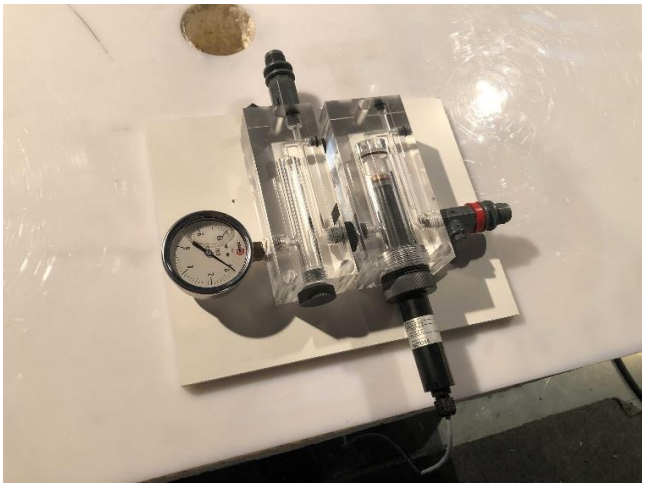
3.1. ENVIRONMENTAL CONDITIONS

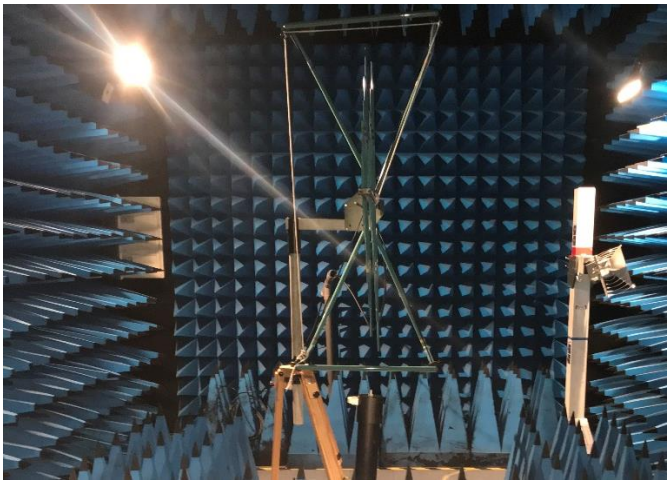
Date of test	:	February 8, 2021
Test performed by	:	Jonathan SARTO
Atmospheric pressure (hPa)	:	985
Relative humidity (%)	:	35
Ambient temperature (°C)	:	20

3.2. 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)
☐ 10cm above the ground on isolating support (Floor standing equipment)
The EUT is powered by V_{nom}.







Test photo setup in anechoic chamber

Test photo setup on OATS

Test method

The product has been tested according to ANSI C63.4, FCC part 15 subpart B.

Pre-characterisation measurement: (30MHz –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 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 30MHz 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 B limits. Measurement bandwidth was 120kHz from 30 MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, 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.

3.3. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Amplifier 100kHz - 18GHz	LCIE SUD EST	_	A7085027	11/20	11/21
Antenna Bi-Log XWing	TESEQ	CBL6144	C2040146	03/17	03/22
BAT EMC	NEXIO	v3.19.1.23	L1000115		
Cable 0.75m	SUCOFLEX	18GHz	A5329919	11/20	11/21
Cable 2.2m N	SUCOFLEX	SF118A/2x11N/2.2M	A5329990	11/20	11/21
Cable 5m	SUCOFLEX	18GHz	A5329918	11/20	11/21
CALCUL_FACTEURS	LCIE SUD EST	V4	L2000035		
Diameter 1.2m / Height 2.25m	LCIE	VSWR 1GHz - 18GHz	D3044015_VSWR	06/19	06/22
Radiated emission comb generator	BARDET	_	A3169050		
Semi-Anechoic chamber #2	SIEPEL	_	D3044015	06/19	06/22
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A4060049	04/20	04/22
Table C2/OATS	LCIE	_	F2000438		
Turntable chamber (Cage#2)	ETS Lingren	Model 2165	F2000404		
Turntable controller (Cage#2)	ETS Lingren	Model 2066	F2000393		
Antenna Biconic	EMCO	3104C	C2040175	03/20	03/22
Antenna Mat (OATS)	ETS Lingren	2071-2	F2000392		
Cable (OATS)	_	1GHz	A5329623	05/20	05/21
Emission Cable	MICRO-COAX	1GHz	A5329656	08/20	08/21
Emission Cable	SUCOFLEX	6GHz	A5329061	06/20	06/21
OATS	_	_	F2000409	04/20	04/21
Receiver 20-1000MHz	ROHDE & SCHWARZ	ESVS30	A2642006	03/20	03/22
Table C1/OATS	LCIE	_	F2000445		
Turntable (OATS)	ETS Lingren	Model 2187	F2000403		
Turntable / Mast controller (OATS)	ETS Lingren	Model 2066	F2000372		

3.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

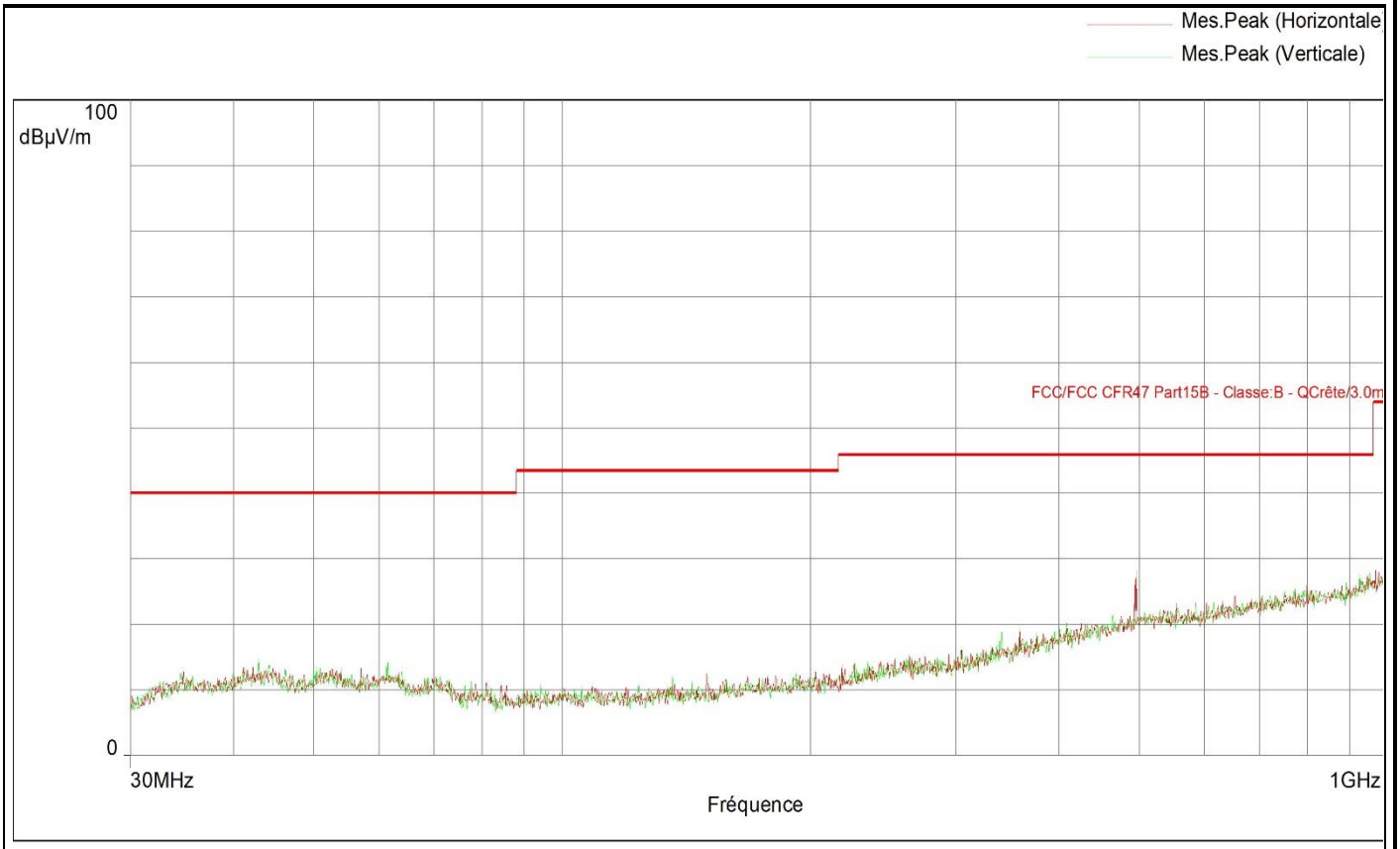
3.5. TEST RESULTS

Pre-characterisation measurement (30MHz-1GHz): pre-scan measurement at 3m (PEAK detection, graph examples)

See graphs:

Graph identifier	Polarization	EUT position	Comments	
Emr# 1	Horizontal & Vertical	Axis XY		See below

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Configuration 1	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization	Correction (dB)
149.697	12.5	Horizontal	-17.4
496.120	28.2	Horizontal	-6.4
653.480	24.4	Horizontal	-4.9
42.886	14.8	Vertical	-16.9
61.603	14.3	Vertical	-15.8
925.200	27.7	Vertical	-1.7

QUALIFICATION (30MHz-1GHz): 10 meters measurement on the Open Area Test Site.
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)	Gain/Loss Factor (dB)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
No significative frequency observed										

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

3.6. CONCLUSION

The sample of the equipment **CAA3206**, Sn: **204500534**, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part15B and ICES-003, for radiated emissions.

4. 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 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 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

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*