

RC051-15-107017-2-A Ed. 1

This report cancels and replaces test report RC051-15-107017-2-A Ed. 0

E.M.C. TEST REPORT

According to the standards:
CFR 47 - FCC Part 15

Equipment under test:
Sofrel S4X-3 Remote Terminal Unit

FCC ID:
RCJS4X

Company:
LACROIX SOFREL

Diffusion: Mr DANTAN

Company: **LACROIX SOFREL**

Number of pages: 33

Ed.	Date	Modified page(s)	Written by		Technical verification Quality approval	
			Name	Visa	Name	Visa
1	9-Jul-18	1	J.L. JAMET	ILJ	L. BERTHAUD	

Duplication of this test report is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above. This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.

S51 RTY 000 CEM 00016 (02)



**NAME OF THE EQUIPMENT
UNDER TEST (E.U.T.)** : **Sofrel S4X-3 Remote Terminal Unit**

Serial number : SF0013101000036

Software version : Test V1.10

MANUFACTURER'S NAME : **LACROIX SOFREL**

APPLICANT'S ADDRESS:

Company : **LACROIX SOFREL**

Address : 2 RUE DU PLESSIS
35770 VERN SUR SEICHE
FRANCE

**Person(s) present during the
tests** : **Mr DANTAN**

Responsible : **Mr DANTAN**

DATE(S) OF TESTS : April 1 & 5, 2016

TESTS LOCATION(S) : EMITECH ANGERS laboratory in BEAUCOUZE (49) FRANCE
Z.I. Angers - Beaucouzé – 15 rue de la Claie – 49070 BEAUCOUZE

EMITECH ANGERS open area test site in LA POUEZE (49) FRANCE
Rue du Chemin Neuf – 49370 LA POUEZE
FCC Registration Number (FRN): 0022150320; TRN: 101696

TESTS OPERATOR(S) : J.L.JAMET

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1. INTRODUCTION

This document submits the results of **Electromagnetic Compatibility tests** performed on the equipment **Sofrel S4X-3 Remote Terminal Unit** (denominated hereafter E.U.T.: equipment under test) according to document(s) listed below.

2. REFERENCE DOCUMENT(S)

The standards and testing methods related throughout this report are those listed below.
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 - FCC Part 15 : 2015

Code of federal regulations

Title 47- Telecommunication Chapter 1- Federal Communication Commission

Part 15- Radio frequency devices Subpart B- Unintentional Radiators

Limits and methods of measurement of radio disturbance

Characteristic of information technology equipment.

ANSI C63.4 : 2014

Methods of Measurement of Radio-Noise Emissions from Low-voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.

3. EQUIPMENT UNDER TEST AND CONFIGURATION SCHEME

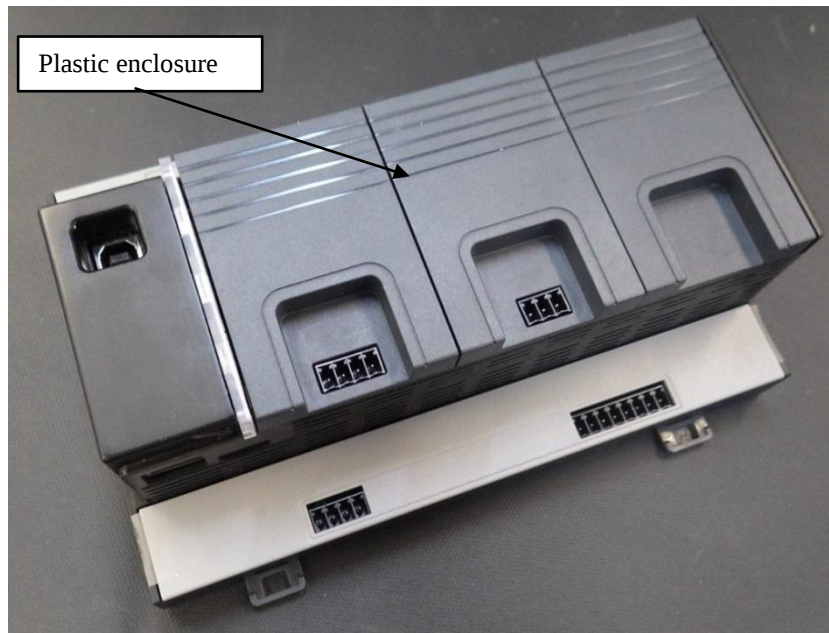
The E.U.T. is a system of acquisition, control-command and communication, dedicated to the water environment. The E.U.T. is a configuration GSM 2G mode

Size of E.U.T. – L x l x h (cm): Casket = 53 x 43 x 21 E.U.T = 23 x 12 x 8

Supply voltage/frequency range: 24Vdc $\pm$ 20%

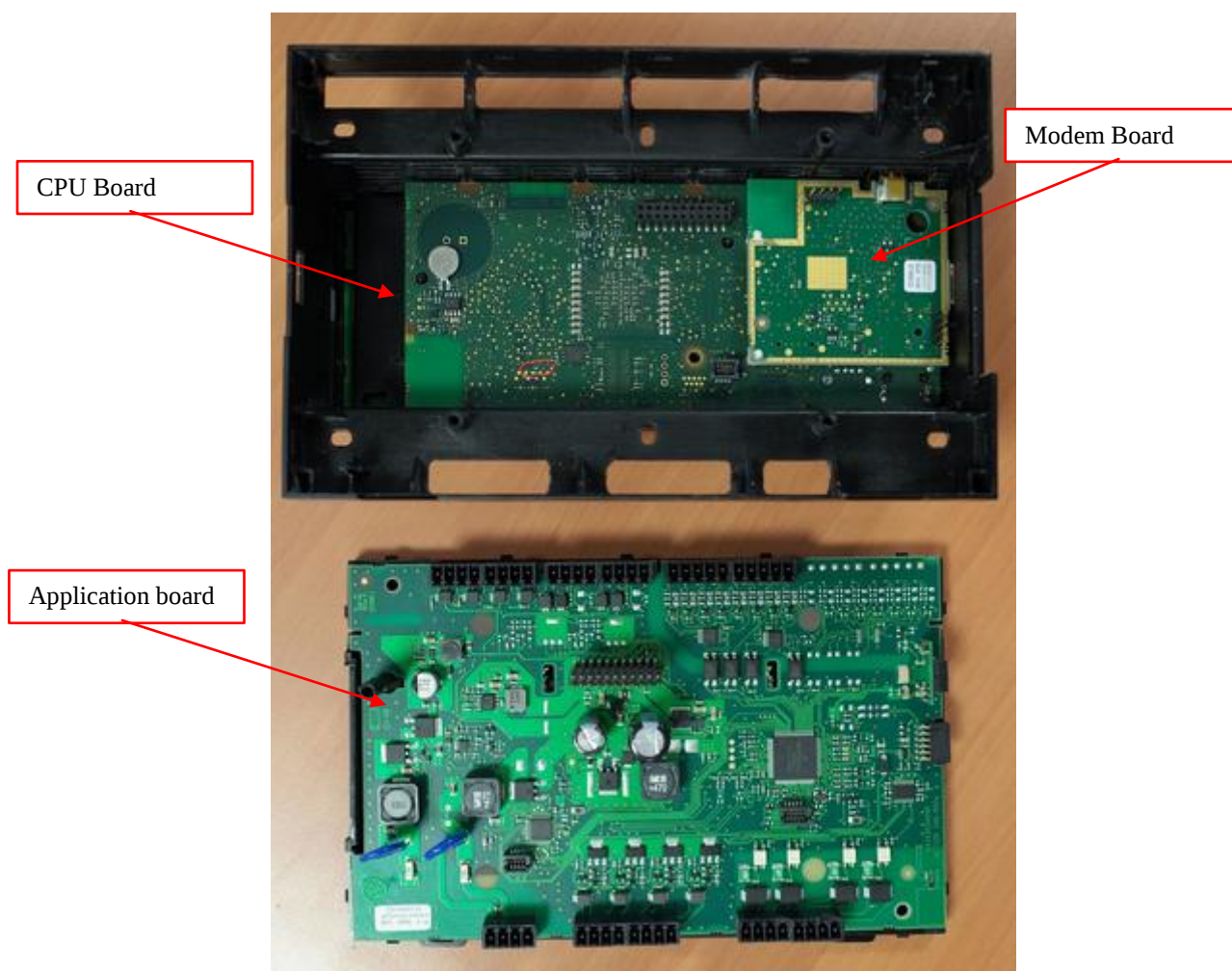
Tested at: 24Vdc

The E.U.T. has a 12 Vdc backup battery





Inside view



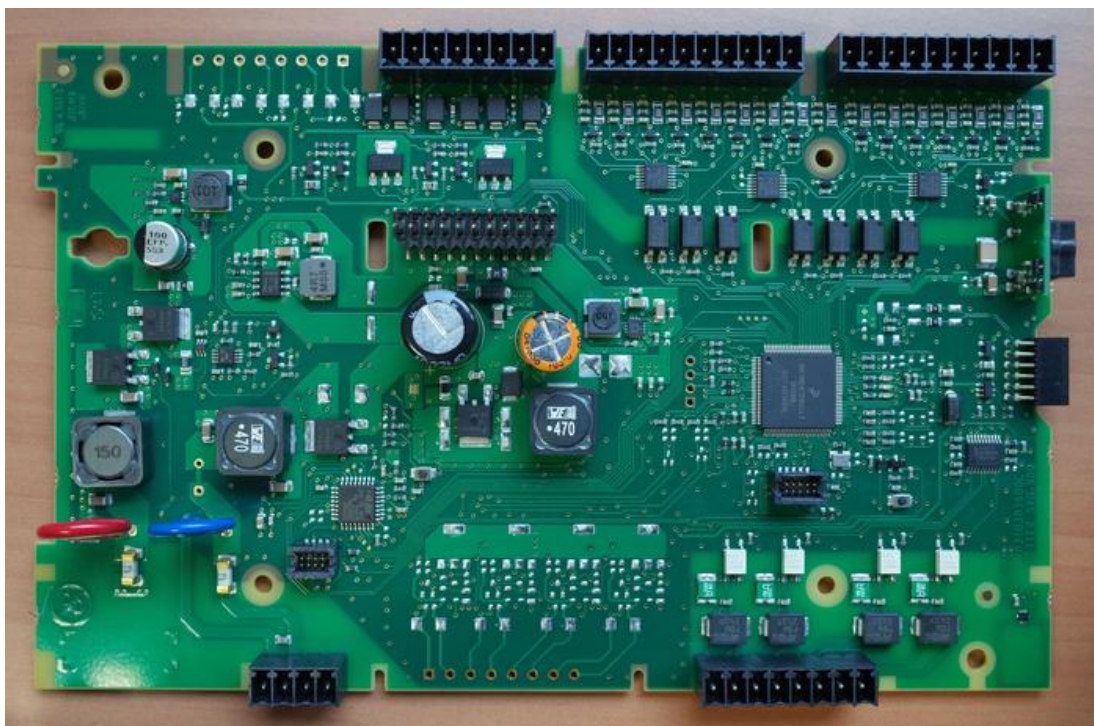
- CPU board
 - ▶ Serial number SF0010330000036



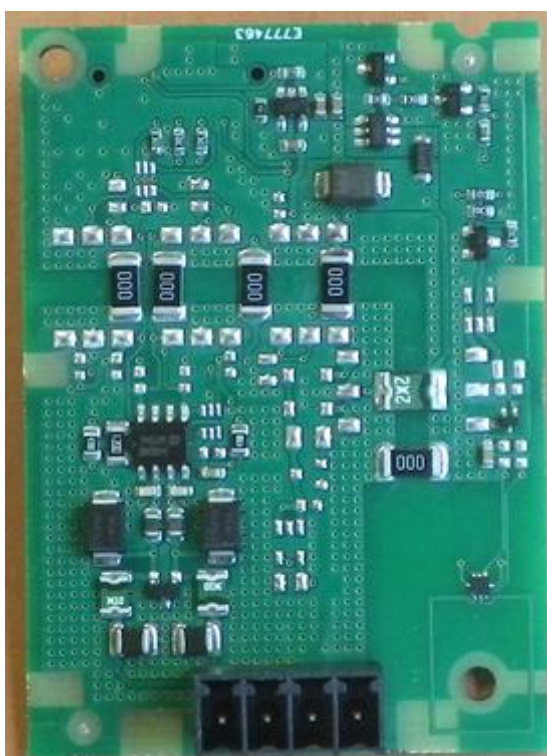
- Modem board
 - ▶ Serial number SF0010343000030



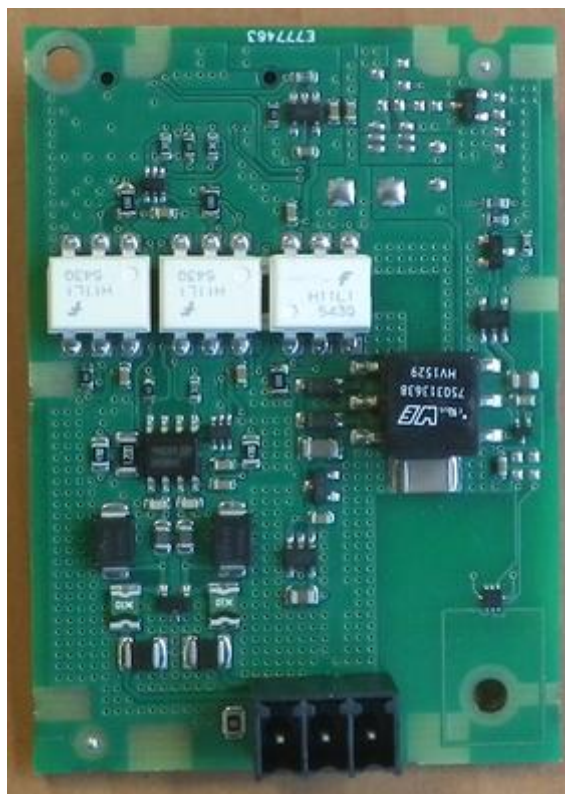
- Application board
 - Serial number SF0010331000038



- RS485a board
 - Serial number SF0010339000021



- RS485i board
 - Serial number SF0010340000027

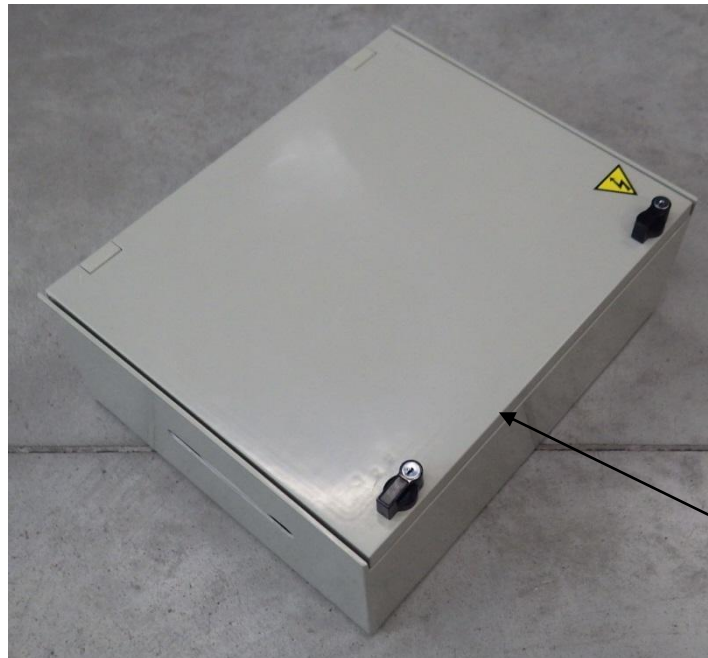


Label of EUT

The updated label for FCC market has not been provided by the applicant.

Test setup

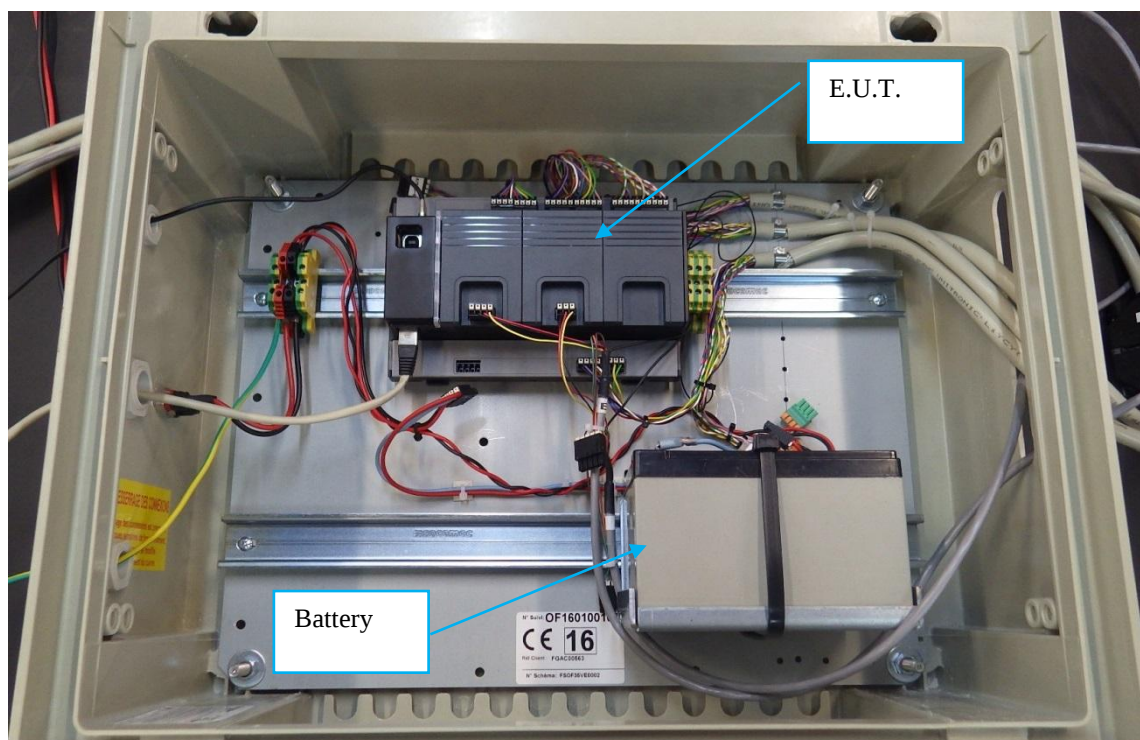
At the request of the applicant the E.U.T. is put in a representative casket for all tests.



Plastic enclosure



Inside view



Antenna



Auxiliary equipments (A.E.) (Equipments not under test) :

Aux1: Laptop

Trade mark: Dell

Reference: Latitude E6540

Serial number: None

Aux2 : Test bench 1

Trade mark: None

Reference : None

Serial number : None

Aux3 : Test bench 2

Trade mark: None

Reference : None

Serial number : None

Aux4 : Radio Communication Network

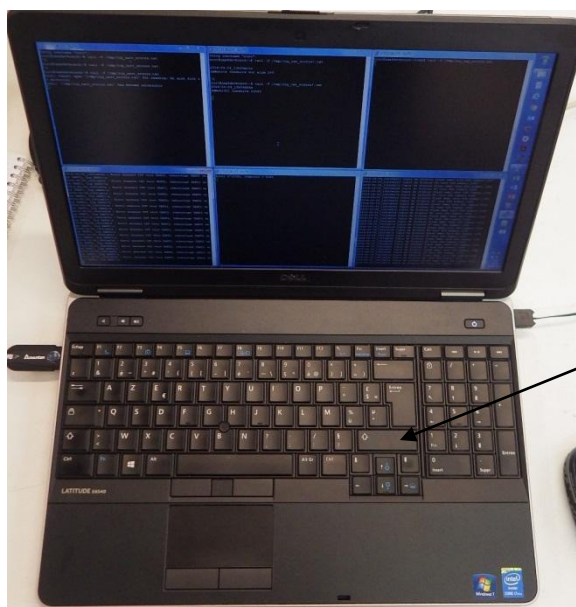
Trade mark: R&S

Reference: CMU 200

Emitech number: 6816

Laptop on battery for tests: EN 61000-4-2 and EN 61000-4-5

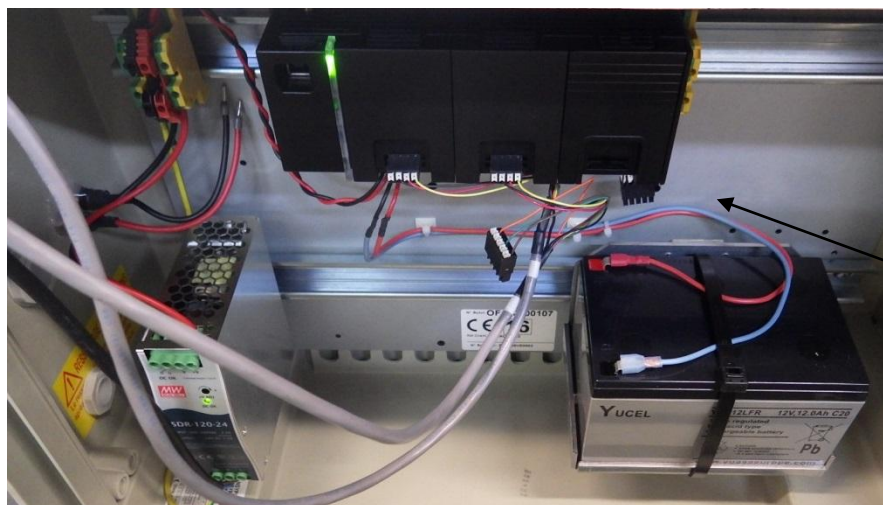
Laptop on AC mains power supply for tests: others tests



Aux 1



Aux 2 outside view



Aux 2 inside view

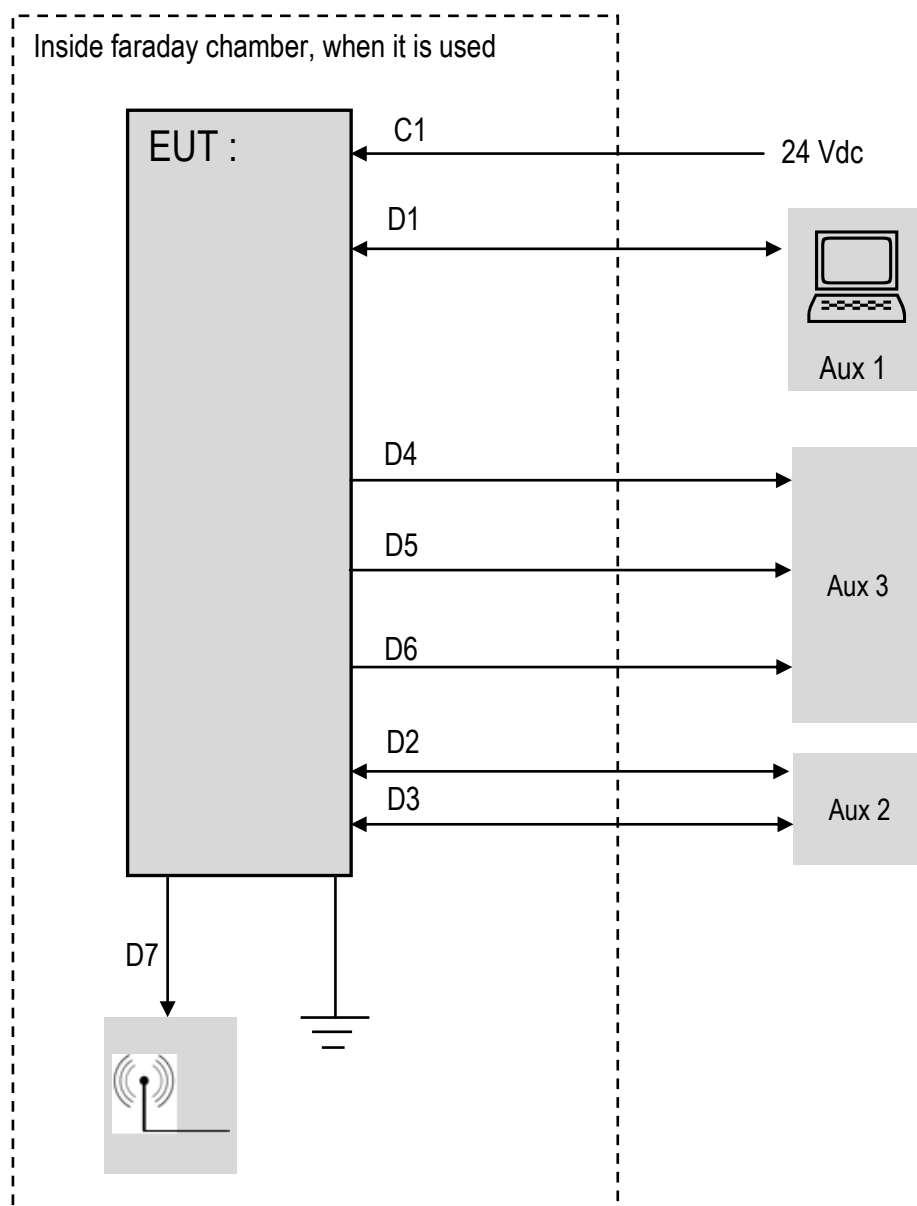


Aux 3

Test configuration scheme :

	DC power input Name	Wires number	PE Yes/No	outside Yes/No	test voltage	Length
C1	Power supply	2	N	Y	24 Vdc	< 3 m

	Data I/O Name	Shielded Yes/No	Max length (m)	outside Yes/No	Length for test
D1	Ethernet	Y	< 30	Y	10 m
D2	RS 485a	Y	> 30	N	7 m
D3	RS 485i	Y	> 30	N	7 m
D4	Digital input (16)	Y	> 30	N	6.5 m
D5	Analog Ai mA input	Y	> 30	N	6.5 m
D6	Digital output (4)	Y	> 30	N	6.5 m
D7	GSM antenna	Y	< 30	Y	3 m



Cycle and operating mode during emission tests:

During tests, the mode of operation was under customer's responsibility.

A test is done via the laptop to verify the coherence between the state of the input/output of the test bench and the state of the input/output of the product (E.U.T.), to verify the absence of errors during the transfers of data Ethernet. The continuity of the communication allows indicating that the product did not have a reset.

A GSM / 2G communication is done between the E.U.T. and the CMU 200 (auxiliary equipment).

The highest frequency generated or used within the E.U.T. is 1990 MHz.

Remark: The EUT operating condition is indicated in the tests, when it is different of that described above.

Equipment modifications applied during tests: None

Information to user: None

4. SUMMARY OF TEST RESULTS

CFR 47 – FCC Part 15

Description of test	Criteria respected ?				Comment
	Yes	No	Nap	Nre	
Conducted emission (§15.107) - On AC power supply cable	X				Class A
Radiated electric field measurement (§15.109)	X				Class A
Labelling requirement and information to user		X			Not provided by the applicant

Nap: Not Applicable

Nre: Applicable, but Not Requested by the applicant

The sample Sofrel S4X-3 Remote Terminal Unit submitted for testing complies with the limits of the CFR 47 – FCC Part 15; 2015, for the §15.107 and §15.109, but the sample does not comply with the rules of the CFR 47 – FCC Part 15 (label and user noticed not provided);
According to modifications, to §3, to limits class A.

Acceptation of test report by responsible party:

Responsible party	
Name	Visa

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s).

Information to user required by used FCC standards:

For conformity towards all requirements FCC standard the following items shall be fulfilled:

USERS NOTICE SHALL CONTAIN**§ 15.105:**

For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

§15.21:

Any changes or modifications to this equipment not expressly approved by Lacroix SOFREL may cause, harmful interference and void the FCC authorization to operate this equipment.

And all other information as stated in GSM module user notice.

EQUIPEMENT LABELING REQUIREMENTS SHALL CONTAIN**§15.19:**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

§15.212

Contains Transmitter Module FCC ID: [XYZMODEL1](#) see exact code on Sierra module label.

Product Regulatory Label Drawing:

Not provided

Product Regulatory Label Placement:

The product regulatory label is affixed as illustrated in the figure below

Not provided

5. CONDUCTED EMISSION

Temperature (°C) : 23

Humidity (%HR): 40

Pressure (hPa): 995

Technician : JL. JAMET

Date : April 5, 2016

Test Location : EMITECH ANGERS laboratory in BEAUCOUZE

Standard(s) : CFR 47 - FCC PART 15

Test method(s): ANSI C63.4

Test method(s) deviation : None

Limits: Class A ; Unintentional Radiators: Sec.15.107

Measurement Expanded uncertainty (dB):

Uncertainties are only considered for the measurement chain.

Uncertainties obtained with K = 2:

150kHz – 30MHz

Conducted emission measurements in voltage with RSIL: 3.38

Conducted emission measurements in voltage with RSI: 3.54

Tested cable(s)	Measure with
A1	L.I.S.N.

Frequency band	Resolution bandwidth (RBW)		Video bandwidth (VBW) For peak measurement with spectrum analyzer
	Detector		
	Average / Quasi-Peak	Peak	
150 kHz – 30 MHz	9 kHz	10 kHz	30kHz

Test configuration:

The EUT is placed on a wooden table at 0.8 m over a horizontal reference plane and 0.4 m from a vertical reference plane. It is powered by an LISN placed on the ground reference plane.

The power cable is arranged to follow the shortest route possible between the EUT and the LISN. Part of the power cable between the EUT and AMN exceeding 0.8 m is folded in a zigzag pattern along the rope, to form a beam of 0.3 m to 0.4 m in length.

E.U.T. operating mode: See §3

Test equipment list:

BAT-EMC software (N° Emitech: 0000) version: V3.6.0.32

CATEGORY	BRAND	TYPE	N° EMITECH
Ground plane	Beaucouzé installation	Test area_HCB1	8915
Thermo-hygrometer	Testo	608-H1	7565
Barometer	Barostar	602M-981B	7588
Multimeter	FLUKE	177	10320
RSIL used to power A.E. equipments	Emco	3825/2	2588
50 Ω	Radiall	R404.111.000	10702
Cable	EMITECH	Sheath current absorber	10652
Cable		N-2m	2745
Cable	/	N-5m	2739
Filter	Rohde & Schwarz	EZ-25	11536
Receiver	R&S	FSEA FSEA (Bios 3.3 Analyseur 3.30)	5071
Repartitor	Radiall	R 582704	8977
RSIL 32 A	AFJ	LT32C	8460

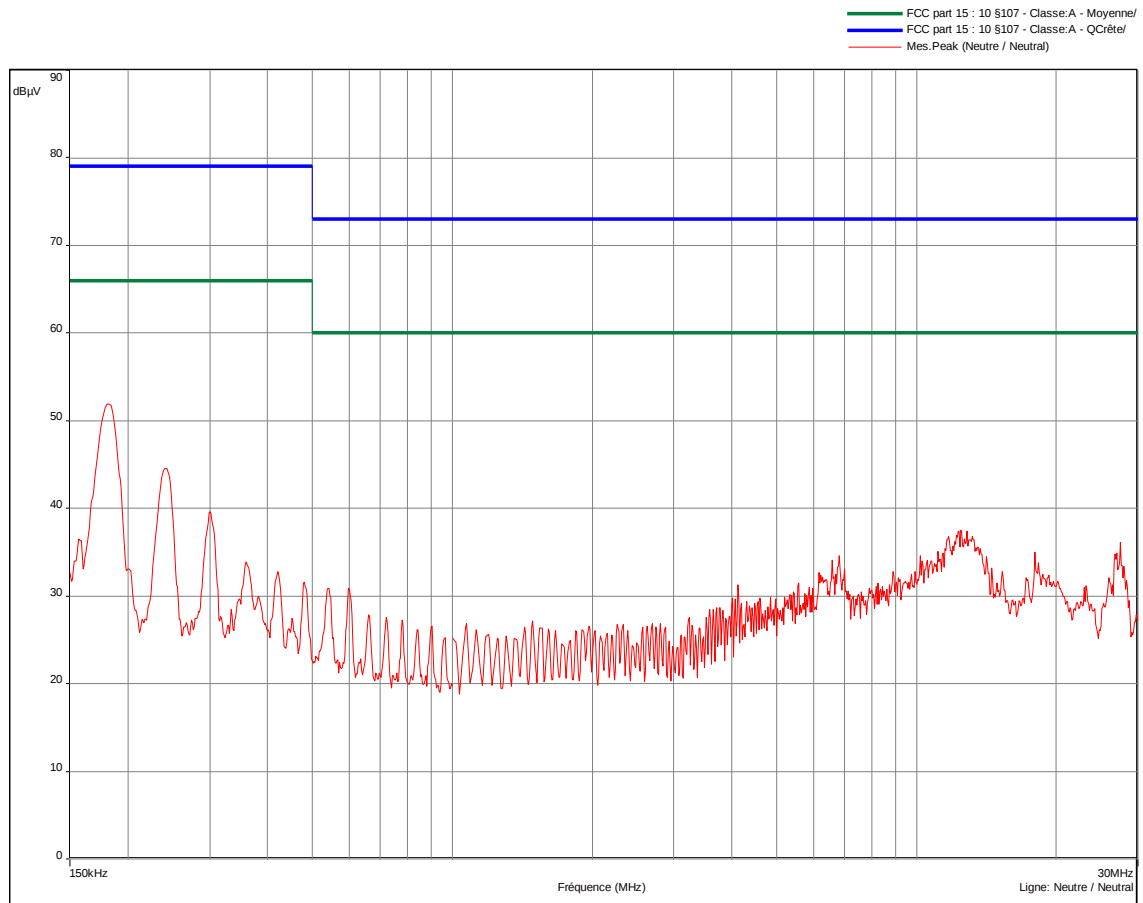
BAT-EMC software (N° Emitech: 0000) version: V3.6.0.32

Photo(s):

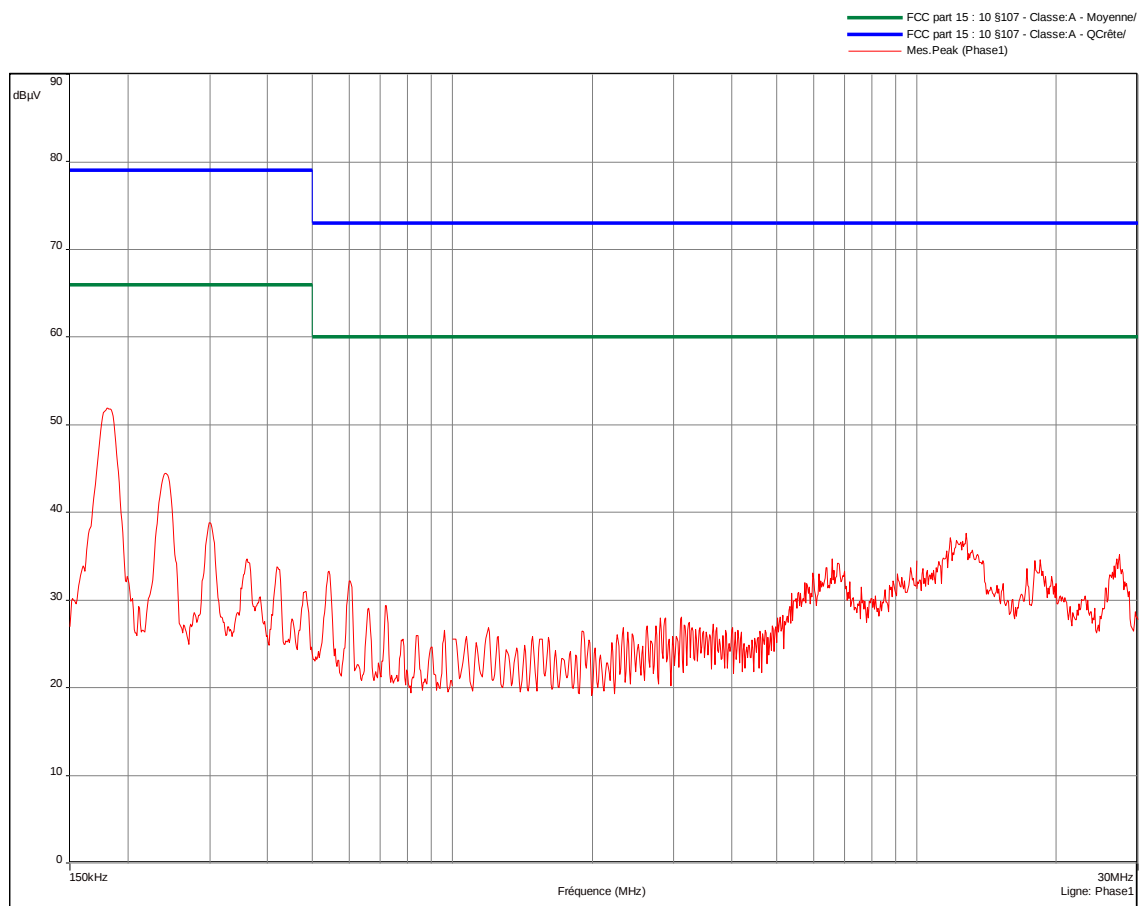


Results: Limits on the graphs are average and quasi-peak limits (upper limit).

Peak measurement on the Neutral wire of the AC power supply access: A1



Peak measurement on the Line wire of the AC power supply access: A1



6. RADIATED ELECTRIC FIELD MEASUREMENT

Standard(s): CFR 47 - FCC PART 15

Test method(s): ANSI C63.4

Test method(s) deviation: None

Limits: Class A; Unintentional Radiators: Sec.15.109

a) Pre-measurement in semi anechoic chamber for $F < 1\text{GHz}$:

Temperature ($^{\circ}\text{C}$) : 21

Humidity (%HR): 35

Pressure (hPa): 1021

Technician: JL. JAMET

Date : April 1, 2016

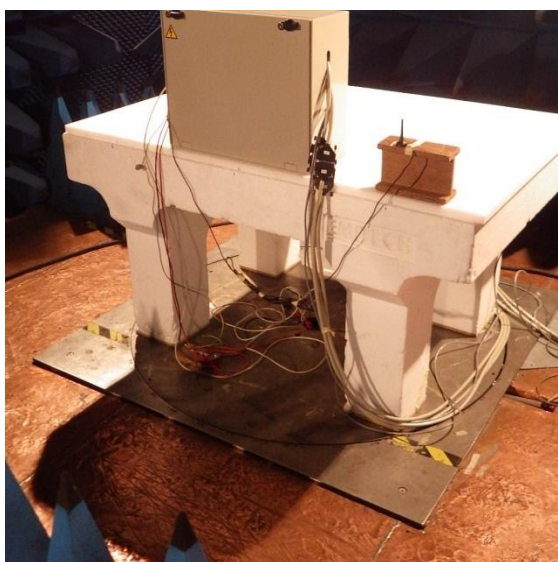
Test Location: EMITECH ANGERS laboratory in BEAUCOUZE

Test configuration:

Frequency band	Tested side	Resolution bandwidth	Video bandwidth	E.U.T. height
30MHz-1GHz	0 to 360°	120kHz	300kHz	80cm

A pre-scan is performed in semi-anechoic chamber at 3 meters. The EUT is placed on the table /support.

Test set-up:



Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Shielded enclosure	SIDT	C.A1	1089
Test receiver	Rohde & Schwarz	ESPC	5275
Bi-conical antenna	ELECTRO-METRICS	BIA-30HF	1103
Log periodic antenna	ELECTRO-METRICS	LPA-30	0842
Spectrum analyser	Hewlett Packard	HP 8594 E	1030
Preamplifier	Mini Circuit	ZFL-1000LN	1766
Cable	C&C	N-2m	10695
Cable		N-5m	2741
Thermo-hygrometer	Oregon scientific	WMR 86	10724
Multimeter	FLUKE	177	10320

BAT-EMC software (N° Emitech: 0000) version: V3.6.0.32

Results:

The frequencies observed are re-measured in open area test site at 10m. See next pages.

b) Measurement on open area test site for $F < 1$ GHz:

Temperature ($^{\circ}\text{C}$) : 21

Humidity (%HR): 32

Pressure (hPa): 1004

Technician : JL. JAMET

Date : April 1, 2016

Test Location: EMITECH ANGERS – Open area test site in LA POUEZE (49)

Measurement Expanded uncertainty (dB):

Uncertainties are only considered for the measurement chain.

Uncertainties obtained with $K = 2$:

Radiated measurements in open area test site:

30 – 200 MHz: 4.84 (biconical antenna)

200 – 1000 MHz: 4.78 (logperiodic antenna)

Test configuration:

For each measured frequency, receiving antenna height varies between 1 meter and 4 meters, E.U.T. is set on a turntable in order to find the highest level. Diagram in 0° position, angles are positives in the reverse clock wise.

Frequency band	Initial position (0°)	Resolution bandwidth	Measuring distance	Detection mode	E.U.T. height
30MHz-1GHz	0° is front side	120kHz	10m	Quasi-peak	80cm

Photo of the test setup:



Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Open area test site	EMITECH	La Pouèze_3m & 10m	1274
Turntable	without	Turntable and antenna positioning open area controller	-
Thermo-hygrometer	Oregon Scientific	AB 888	1539
Biconical antenna	Hewlet Packard	11966 C	0728
Log periodic antenna	Rohde & Schwarz	HL 223	1999
Cable (measure at 10m)	C&C	N-19m	5417
Dispatcher	-	2 channels	8996
Cable	-	N-1m	8998
Test receiver	Rohde & Schwarz	ESVS 10	1219

Results:

Frequency (MHz)	Polarization V : vertical H : Horizontal	Azimut (degrees)	Height of antenna (cm)	Quasi-Peak Measurement (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Margin Quasi-Peak (dB)
41.60	V	0	100	22.2	39.0	16,8
46.00	V	93	100	22.8	39.0	16,2
67.70	V	0	100	22.6	39.0	16,4
167.5	V	0	100	25.6	43.5	17,9
250.0	V	0	100	38.9	46.4	7,5
350.0	V	190	100	31.8	46.4	14,6
500.0	V	172	280	31.1	46.4	15,3
550.0	V	47	100	36.6	46.4	9,8
750.0	V	209	223	37.2	46.4	9,2
850.0	V	285	150	42.6	46.4	3,8
850.0	H	50	400	42.7	46.4	3,7
750.0	H	140	100	39.6	46.4	6,8
650.0	H	72	100	38.4	46.4	8.0
550.0	H	234	100	40.2	46.4	6,2
450.0	H	159	100	36.6	46.4	9,8
250.0	H	360	295	38.8	46.4	7,6

c) Measurement in faraday chamber for $F > 1$ GHz at 3 meters:

Temperature (°C): 21

Humidity (%HR): 35

Pressure (hPa): 1021

Technician : JL. JAMET

Date : April 1, 2016

Test Location: EMITECH ANGERS laboratory in BEAUCOUZE

Test configuration:

Receiving antenna height is fixed. For each measured frequency, E.U.T. is set on a turntable in order to find the highest level. Diagram in 0° position, angles are positives in the reverse clock wise.

The highest frequency generated in the device is $F = 1990$ MHz.

According the standard, the frequency range measured is indicated in the following table:

Unintentional Radiators: Sec.15.109

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower, upper is 9.950 GHz

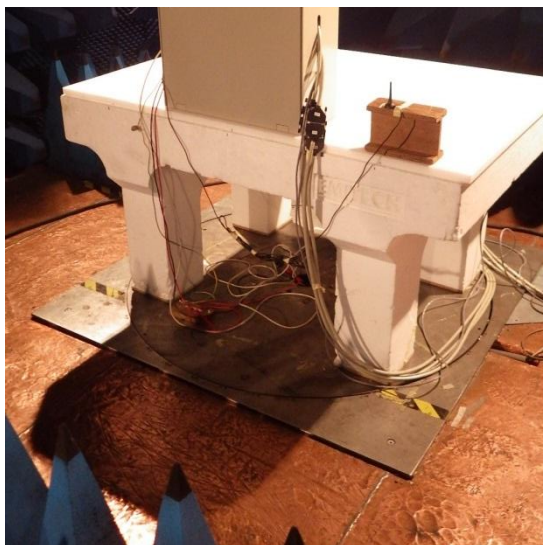
E.U.T. height : 80cm

Initial position (0°): 0° is front side

Frequency band: 1GHz-9.95 GHz

Detection mode	Resolution bandwidth	Video bandwidth
Peak	1MHz	3 MHz
Average	1MHz	1 kHz

Photo of the test setup:



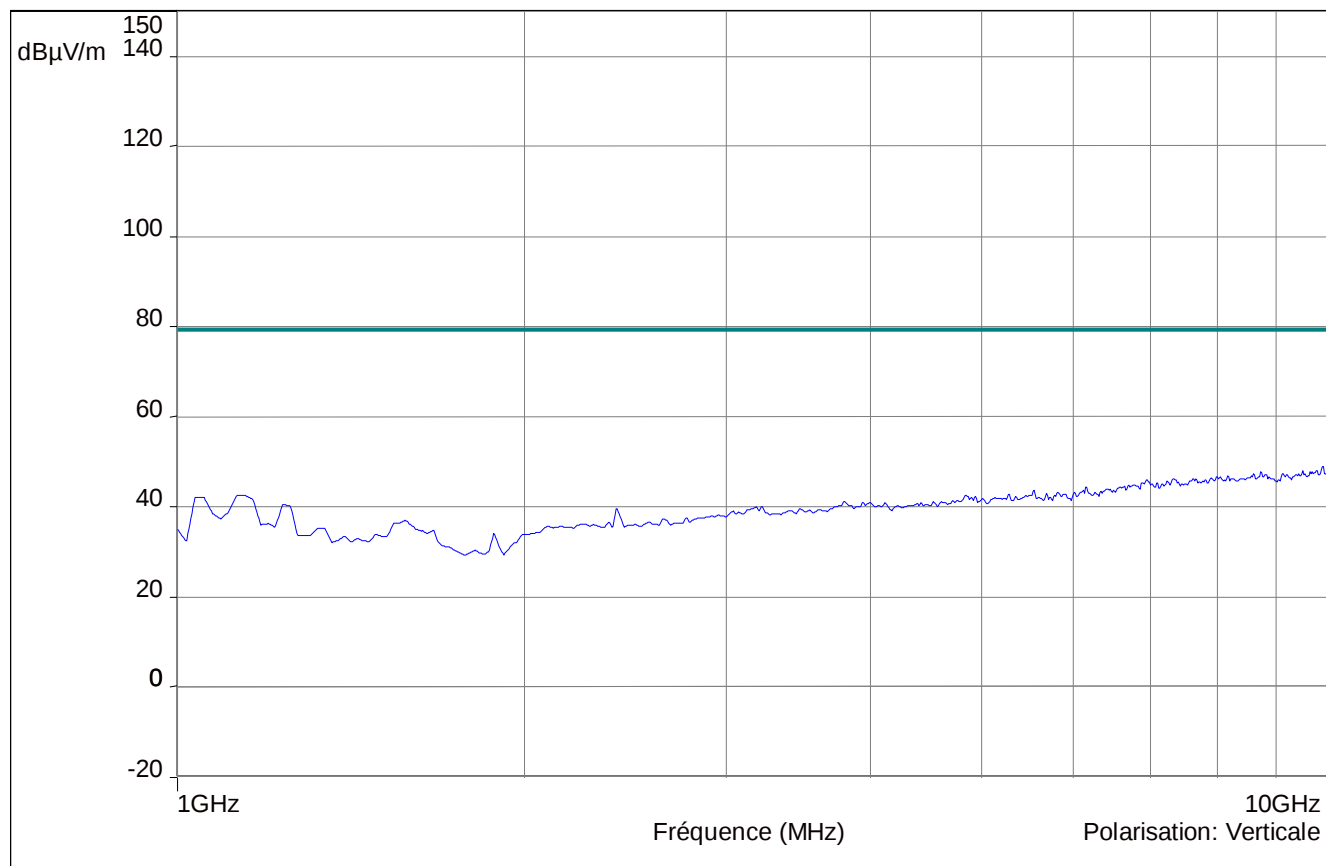
Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Shielded enclosure	SIDT	C.A1	1089
Turntable	without	Turntable controller CAGE1B	-
Double ridged guild antenna	ETS	3115	9712
Pre-amplifier 0.5-18GHz	Lucix Corporation	S005180M3201	10803
Cable 18GHz	C&C	N-2m	10695
Cable 18GHz	C&C	N-5m	10696
Spectrum analyser	Rohde & Schwarz	FSEM 30	7389
Thermo-hygrometer	Oregon scientific	WMR 86	10724

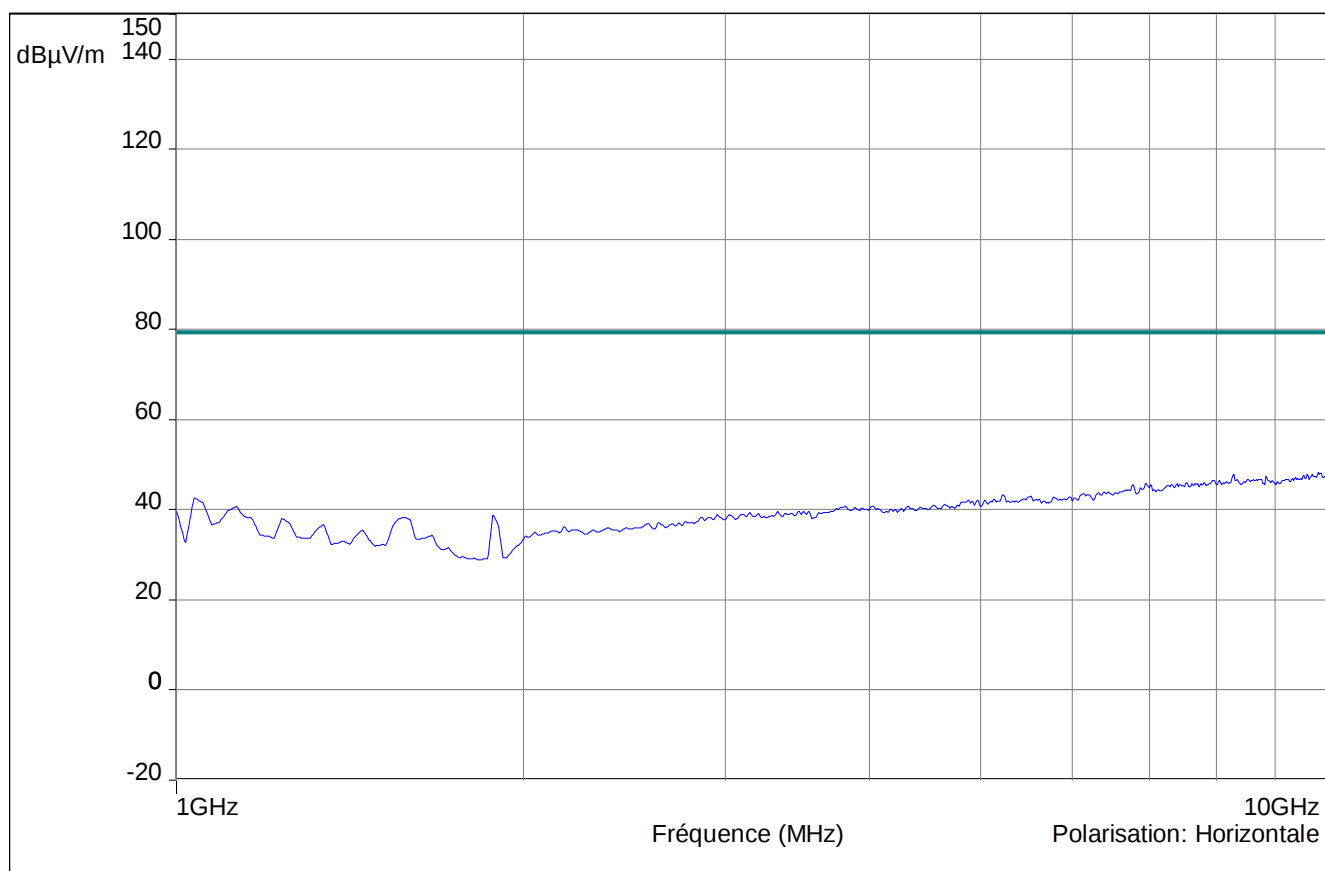
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Results:

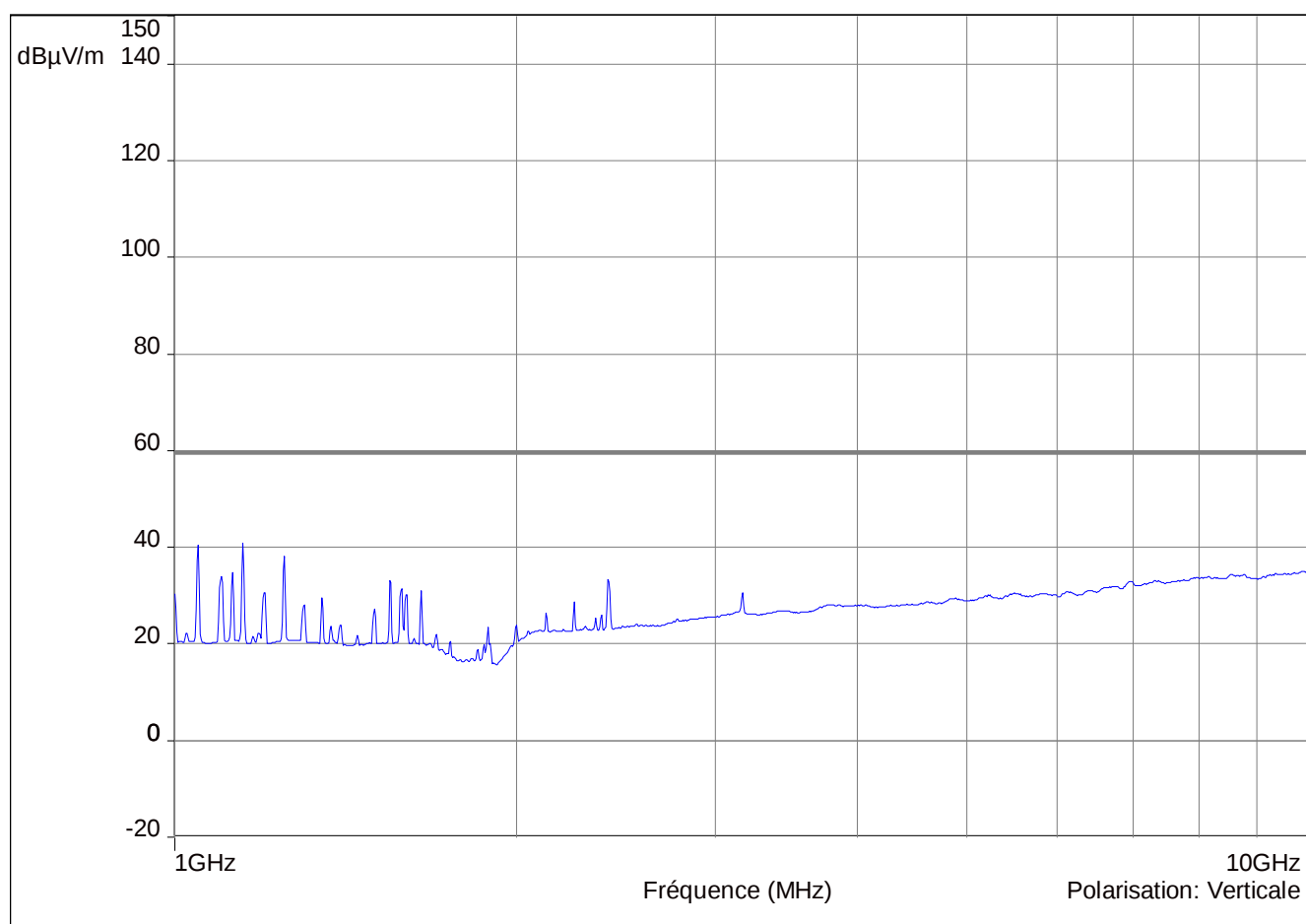
Peak measurement in vertical polarization at 3 meters



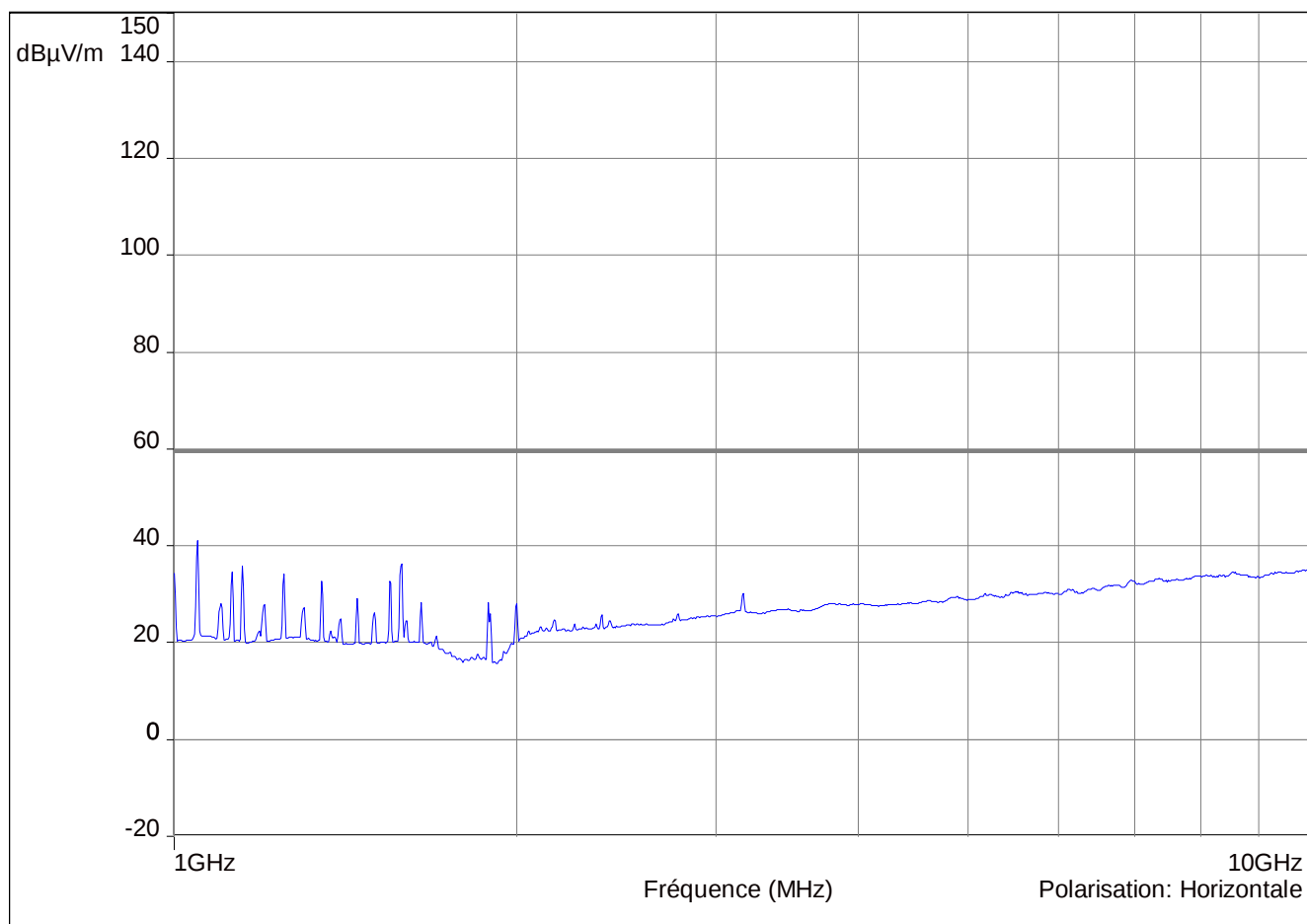
Peak measurement in horizontal polarization at 3 meters



Average measurement in vertical polarization at 3 meters



Average measurement in horizontal polarization at 3 meters



End of report